Talent research from a social science perspective

Theoretical, methodological, and empirical deliberations

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"Fähigkeiten sind nichts ohne Möglichkeiten" (Napoleon)

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Jannika John

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1 Introduction

1.1 Problem Statement

Extraordinary achievements and accolades of athletes, musicians, scientists, artists, and the like have attracted the attention of researchers for quite a long time. Beginning with the work of Galton (1869) on the family histories of eminent British men, talent research has seen a rise in various academic disciplines, particularly within the fields of sports science and education sciences.

Historically, the debate on how a small number of individuals achieve performances that seem unattainable for many others has long been dominated by the nature-vs.-nurture controversy (Galton, 1875). Whereas one line of research emphasizes the role of innate abilities (nature) for attaining extraordinary performances, another line of research focuses on the role of contextual factors (nurture) such as social support or practice conditions. While most talent researchers nowadays acknowledge the importance of nature and nurture for the attainment of high-achievement, we still observe a lack of an overall theoretical perspective that considers the dynamic, interactionist, and multidimensional nature of talent development.

Talent and its identification and development are researched from different academic disciplines such as physiology, medicine, and psychology. Dependent on the respective academic discipline, other structures, abilities, and traits that may predict and explain future performance (cf. Tranckle & Cushion, 2006) are at the center of research efforts (for example, motivational factors if research is conducted from a psychological perspective). Most empirical talent research is carried out with the underlying assumption that different components (such as technical skills, tactical skills, cognitive skills, psychological skills,

physiological characteristics) eventually determine performance in one specific domain (such as male soccer) and can be identified in younger ‘talents’ to predict future top performances. The characteristics deemed important for future success are mostly decided on the basis of characteristics of current top performers. A disadvantage of this strategy for talent identification and development is that it does not consider possible developments in the performance domain itself. Tactics and techniques might change and evolve in the future, so what makes someone successful today might not be the same as in twenty years.

Herewith, it becomes apparent that talent development cannot be researched and understood without understanding the specific social context in which development occurs. From a social science perspective, which talent researchers have scarcely adopted, the development of talent is part of a social context that provides norms and ideas on talent-related characteristics, normative (talent) developmental pathways, and behavioral expectations for those considered talented. However, the individual considered talented can also not be reduced solely to talent-related characteristics; he or she enters an achievement domain with his or her own history that also shapes how ‘inputs’ from the environment (such as interventions, practice strategies, or life events) are processed and given meaning. Thus, the dissertation’s main research interest focuses on how an individual with his or her unique history can be made fit to the structural peculiarities of the respective achievement context or how the context can be made fit to the individual. To address this question, I offer theoretical, methodological, and empirical deliberations from a social science perspective that considers ‘the personal’, ‘the social’, and their complex interactions within the talent development pathway. Seven research papers build the basis of these reflections, with three theoretically oriented papers, three methodologically oriented papers, and one empirical paper.

1.2 Structure of Dissertation

Within chapter 2, I revisit the state of talent research. Here, I provide an overview of the most important terms and definitions, the field's history, recent advances and developments, commonly used theoretical models, and typical research questions and current findings. At the end of Chapter 2, I summarize the research desiderata within talent research on a theoretical, methodological, and empirical level.

The guiding theoretical perspective of the dissertation is presented in Chapter 3. Here, I develop and discuss a social constructivist perspective on talent and its development. As a first step, the basic assumptions of social constructivism and its epistemological interest are described. Next, I illustrate how talent can be framed as a social construct. Following these first theoretical reflections and the desiderata identified within Chapter 2, it is necessary to develop a theoretical framework that considers personal and social factors and their interaction during the talent development process. The person considered talented develops in the life world of the respective achievement domain but already enters this context with his or her own history. Thus, I first characterize the life worlds of individuals considered talented; here, I focus on the domains referred to most often in talent research, namely sports, music, and mathematics. I specifically focus on the structural constraints, opportunities, and pressures within each of the three different achievement domains. However, from a social constructivist perspective, the history of the individual shapes how the individual interprets these characteristics of the life world. Thus, in the next step, I connect the concept of the life world to the concept of narrative that provides a bridge between 'the personal' and 'the social'. Here, I present a conceptual framework that depicts how life events and experiences build the foundation of the biography and the personal life story while also considering the sociocultural embeddedness of individuals into their respective life worlds.

In Chapter 4, I offer preliminary conclusions; then, I derive the overarching research questions of the dissertation project that were answered in seven articles. These seven articles constitute the main part of Chapter 5. Before the full-text version of each article is presented, a tabular list of all articles, including each article's main objective and my contributions to each article, can be found. The first three articles offer theoretical deliberations; the following three papers present methodological deliberations. The final empirical paper of the present dissertation aims to bring together most of the theoretical and methodological suggestions formulated in papers one through six.

In Chapter 6, I summarize and discuss the key findings of the seven articles. At last, I derive implications for future talent research as well as five central theses for talent management strategies.

2 Talent and Giftedness Research Revisited

Research on why and how some individuals attain high levels of achievement mainly refers to two terms: talent and giftedness. Sports scientists primarily use the term talent when talking about the potential for athletic high-achievement. However, when educational scientists talk about the potential for academic or intellectual high-achievement, they tend to use the term giftedness. In the following review of research, I adhere to these terminological and disciplinary conventions and discuss the definition of the terms talent, giftedness, and high-achievement.

2.1 Terms and Definitions

2.1.1 Talent

Talent can be considered a raw and valuable resource for society. Surprisingly, researchers have paid relatively little attention to the concept of talent from a broad conceptual standpoint leading to a lack of definitional and conceptual clarity (Tranckle & Cushion, 2006).

Accordingly, a great variety of definitions and conceptualizations of the term talent exists in sports science. Across different countries, we can find different underlying assumptions and associations relating to the term talent. For instance, in German-speaking countries, the term talent often refers only to young performers, denoting a potential for future top performance. In contrast, in Anglo-American contexts, the term talent is also used for current top performers (Güllich, 2013).

In the German-speaking context, Hohmann and Carl (2002) differentiate between narrow and wide conceptualizations of athletic talent, and Joch (1992) notes the difference between static and dynamic conceptualizations of athletic talent. The respective assumptions are summarized in Table 1.

Table 1

Narrow vs. wide, static vs. dynamic conceptualizations of talent (adapted from Güllich, 2013; based on Hohmann & Carl, 2002; Joch, 1992)

Narrow	**Wide**
- Talent is characterized by noticeable early positive sports performances. - It is assumed that those young athletes who displayed the highest performance in childhood and adolescence also attain the highest level of performance later in life.	- Besides sports performance, a wide conceptualization of talent also includes characteristics of practice, the personality, and the social environment, which are thought to have favorable effects on training and performance development. - It is assumed that those children and adolescents display the highest potential for later top performances who possess a high potential for sports performance based on their motor skills coupled with favorable personal and environmental conditions for practice and competition.
Static	**Dynamic**
- Talent is determined based on one assessment at a certain point in time.	- Talent is determined based on several assessments at different time points.

Based on the sports scientific literature on talent, Güllich (2013) concludes that talent refers to a person who is still in the process of development towards his or her individual peak performance in a specific sport and from whom it is expected to develop an exceptionally high performance capability and success in elite sports in the future (p. 628; own translation).

Gallardo-Gallardo et al. (2013) offer another way to differentiate conceptualizations of talent for the field of work and business. The authors identified subject- (talent as an individual) or object-related (talent as ability) approaches to talent, innate (nature) vs. acquired (nurture) conceptualizations of talent, or approaches that focus on input (such as abilities and motivation) or output of talent (such as excellent performance and success). Within Table 2, I use their differentiation to categorize exemplary talent definitions from the sports scientific literature.

Table 2

Conceptualizations of athletic talent

Talent	
… as an individual (e.g., Gabler & Ruoff, 1979; Williams & Reilly, 2000)	… as ability (e.g., Gray & Plucker, 2010)
… as innate (e.g., Baker et al., 2019; Brown, 2002)	… as acquired (e.g., Gagné, 1995)
… related to input (such as abilities and motivation) (e.g., Csikszentmihalyi et al., 1993)	… related to output (excellent performance and success) (e.g., Abbott & Collins, 2004; Faber et al., 2016)

To summarize, many conceptualizations of talent are often relatively narrow and unilateral with significant heterogeneity even within sports science. Most definitions additively list characteristics of talent rather than defining the construct itself (Tranckle & Cushion, 2006). The lack of a clear understanding of the construct talent inevitably has consequences for research on talent identification and development; most talent research cannot be integrated, which ultimately stalls scientific progress.

2.1.2 Giftedness

While the term talent is used for a set of skills or an individual, the term giftedness refers only to an attribute or a set of skills, which slightly facilitates the definition of the term. It is generally agreed upon that giftedness is relative and domain-specific (i.e., someone who is gifted in mathematics is typically not also assumed to be gifted in music), reflects the values of a society, and typically manifests itself in performance outcomes (Subotnik et al., 2011, p. 7).

Within educational and intellectual domains, giftedness is often closely associated or even equated with the construct of intelligence (Gagné, 1995; Subotnik et al., 2011), which

comes with its own problems and controversies (see, for example, Ferrero et al., 2021) that will not be elaborated further as part of the dissertation.

For a century, researchers have tried to define, understand, measure, and explain giftedness (Subotnik et al., 2011). Still, we can find numerous definitions of giftedness that range in terms of their restrictiveness from conservative to liberal ones (Renzulli, 2002). A historical, conservative example is the definition of giftedness by Terman (1925) – one of the first leading scholars in giftedness research. Within his work, he defined giftedness as the top 1% in general intellectual ability. An advantage of such a conservative definition is that it provides a clear cut-off criterion. However, many scholars and practitioners reject such restrictive definitions of giftedness since they overlook numerous students whose performance potential cannot be judged by intelligence tests only (Renzulli, 2002). As a consequence, more liberal and multifaceted definitions of giftedness evolved that also consider a broader range of performance areas (e.g., Renzulli, 2002; Sternberg, 1997; Subotnik et al., 2011).

Recently, Subotnik et al. (2011) have offered a broad definition of giftedness that can be applied to all domains of endeavor. They construe giftedness as "the manifestation of performance or production that is clearly at the upper end of the distribution in a talent domain even relative to that of other high-functioning individuals in that domain" (Subotnik et al., 2011, p. 7). Here, the term giftedness is not solely used to refer to academic achievements but is also applied to other 'talent domains' such as sports, music, or arts. In childhood, potential often serves as the indicator for giftedness; in the later stages of a career, achievement serves as the measure of giftedness (Olszewski-Kubilius & Thomson, 2015). Thus, while talent and giftedness may refer to future achievement, the measure of both is often actual high-achievement.

2.1.3 High-achievement

The term high-achievement is mainly associated with success, without any explicit and implicit assumptions on whether such success is the result of hard work, persistence, effort, natural ability, giftedness, or talent. Thus, it appears to be the least contested term since it tries to steer away from sometimes ideologically led debates on the origins and causes of extraordinary performances. If an individual is called a 'high-achiever', we mainly refer to his or her current performances in relation to peers and do not issue any implicit claims on whether the same individual showed potential for future success as a child, as would be the case if we attach the label 'gifted' or 'talented' to this individual – at least according to common conceptualizations of both terms. However, the term high-achievement is a relative term, and there is still debate on what criteria should be used to operationalize high-achievement in different achievement domains (cf. Gagné, 1995; Swann et al., 2015).

To sum up, for both terms giftedness and talent, we can assert that "no consensus seems to exist about their exact meaning" (Gagné, 1995, p. 103), which still holds true even 25 years after Gagné issued this claim. Despite the terminological and conceptual ambiguity of the terms talent, giftedness, and high-achievement, we can identify two broad fields of research – typically framed as talent and giftedness research – that are concerned with the development of high-achievement within a given performance domain.

2.2 Lines of Research

In the following, I present both lines of inquiry (i.e., talent and giftedness research) separately; however, it should be kept in mind that no clear boundaries between both fields can be drawn. Rather, such a distinction is terminological and, to a certain degree, artificial and mainly related to disciplinary conventions instead of actual differences in the researched phenomenon. Still, in the following, I adhere to these disciplinary conventions in that I refer

to sports scientific talent research in Chapter 2.2.1 and to giftedness research with its origins in psychology and educational science in Chapter 2.2.2. Within both sub-chapters, I particularly focus on the historical origins of both fields, their development over the years, investigated research questions, and theoretical and methodological approaches typically employed.

2.2.1 Talent research

The historical origins of talent and giftedness research share some overlap. Researchers describing the historical development of the respective field (e.g., Baker et al., 2020; Den Hartigh et al., 2018; Den Hartigh et al., 2016; Güllich, 2013) tend to begin with Galton's (1869) study on the heredity of genius. In this study, Galton (1869) examined the family trees of eminent individuals, among which were scientists, musicians, but also wrestlers and rowers, which is the reason why also sports scientists date the beginning of talent research back to the mid-1800s (see Baker et al., 2020). Since Galton noticed that the relatives of these eminent individuals were often excellent performers as well, he concluded that nature prevails over nurture (Galton, 1869). Four years later, DeCandolle (1873) challenged Galton's conclusion in that he noted that excellent scientists were raised under beneficial environmental circumstances (Den Hartigh et al., 2016, p. 2). This observation led him to conclude that a stimulating environment (i.e., nurture) is key to excellence. Therewith, the stage was set for the nature-vs.-nurture controversy (Galton, 1875), which still influences current views on the development of high-achievement in talent and giftedness research (Den Hartigh et al., 2016).

Over a century later, talent research still faces the challenge of understanding how idiosyncratic talent development trajectories are shaped by the complex interplay between nature and nurture (Den Hartigh et al., 2018). The ongoing debate about the relative

contribution of nature and nurture and inconsistencies in the used terminology have restricted the development of knowledge in the field (Vaeyens et al., 2008).

2.2.1.1 Mapping the development of the field

According to Güllich (2013), the field of talent research can be divided into the following overarching categories: (a) talent identification and selection, (b) talent development, and (c) talent support. These categories also reflect the historical and temporal development of the research field.

(a) Talent identification and selection

The great majority of talent-related research in sports science is concerned with the early identification and selection of talent. Within such research efforts, it is assumed that long-term performance development can be predicted at an early age. Talent identification research investigates a wide variety of categories as early predictors for future performance development ranging from physique, early sport motoric performances, practice and training characteristics, personality and psychological skills, physical and mental robustness, to features of the social environment (Güllich, 2013; Williams & Reilly, 2000). Most research attention is paid to physique and characteristics of sport motoric performance (Güllich, 2013).

However, most talent identification research does not do justice to the complex interactions between individual factors and the environment; also, the non-linearity of these interactions is not taken into account. Most early talent identification and selection strategies rest on the assumption that talent is a fixed capacity that can be identified early (Baker et al., 2017). However, the characteristics that contribute to elite performance might be very different from those associated with the potential to develop successfully (Abbott et al., 2005; Martindale et al., 2005). What complicates things even further and is often not taken into account in current talent identification approaches is the changing nature of sports. Rules,

tactics, game strategies, and techniques change continuously; thus, selecting talents also requires predicting the future of sports (Baker et al., 2017).

Since the 1990s, we can observe a shift from research mainly focusing on identifying talent to research that asks how ‘talents’ (if understood as individuals with a high potential for future top performance) develop into successful elite performers.

b) Talent development

Within talent development research, the focus is placed on developmental stages and the necessary personal and contextual conditions within each stage (Seidel, 2011). Most research in this area investigates the developmental pathways of current top performers (Güllich, 2013).

Based on retrospective reports, Bloom (1985) divided the talent development pathway into three stages, which were further developed and discussed in the developmental model of sport participation (DMSP) by Côté (1999), which represents the most cited model in sports scientific talent research (Bruner et al., 2009). During the sampling years, the young athlete acquires experiences in different sports mainly through activities that can be characterized as deliberate play (Côté, 1999). When he or she begins to focus on one sport, he or she enters the specialization years during which the training volume increases and success in competitions becomes more important. During the investment years, the individual focuses entirely on deliberate practice and success in competitions within one specific sport, the training volume still increases, and non-athletic parts of life are subordinated to athletic pursuits (cf. Bloom, 1985; Côté, 1999).

The DMSP raises the critical questions for talent development research whether it is favorable for athletes to specialize early or to diversify early, and what the appropriate amounts of deliberate play (Côté, 1999) and deliberate practice (Ericsson et al., 1993) are for

the development of high performance (Gobet, 2013). The debate on both questions is still ongoing, with inconclusive empirical results (Seidel, 2011).

More recently, talent research has begun to address how talent development can be supported through organizational structures and measures of support that target the individual athlete.

c) Talent support

In this regard, Güllich (2013) identifies the following assumptions underlying current talent support strategies: (a) talent can be recognized early, with early successes presenting valid predictors for long-term potential; (b) success in elite sports represents the outcome of long-term linear developments in one sport while being continuously part of a support system; (c) success increases over time through long-term engagement and increasingly higher training volumes that are accompanied by increasing amounts and intensity of mentoring (Güllich, 2013).

However, most empirical analyses illustrate that most athletes selected and supported at an early developmental stage do not become elite athletes, whereas most current top performers were not part of talent support programs early on (Güllich & Emrich, 2014; Martindale et al., 2005). Several explanations for such findings are possible. At an individual level, coaches and athletes often focus on early and fast success rather than long-term development. Support strategies reinforce these individual tendencies through their focus on increases in training volumes and involvement in competitions. At a societal level, talent support organizations are pressured to justify the financial investments in their activities; this is often achieved through early successes of those supported in their programs – often at the cost of long-term developmental strategies (Güllich, 2013).

Contemporary theorists almost universally agree that the talent development process is idiosyncratic, dynamic, and unpredictable (Martindale et al., 2005). However, standard

support strategies for talent development still focus on progressing those identified as talented at an early point in time while removing large numbers of players along the pathway when they do not fulfill formal thresholds for selection. Standard models of talent development still presume that early ability is indicative of later success, and early specialization is required to achieve expert performance (Bailey & Collins, 2013).

According to recent theoretical developments, the emergence of talent is mediated by intrapersonal and environmental catalysts, in addition to considerable amounts of practice (Simonton, 1999; Ziegler & Heller, 2000). Consequently, standard talent practice has to depart from its heavy emphasis on talent identification and move towards offering developmentally appropriate activities and environments (Bailey & Collins, 2013).

As Baker et al. (2020) summarize, talent identification, talent selection, talent development, and talent support represent critical areas of inquiry for researchers within sports science, which is reflected in a high amount of research attention dedicated to such questions. However, research also suggests that our ability to identify, select, develop, and support talent is still imperfect. Inconsistencies in the definition and operationalization of talent (see Chapter 2.1.1) leave the field of talent research rather fragmented. Not surprisingly, the already criticized terminological and conceptual ambiguity with regard to talent is also reflected in the variety of theoretical models that are usually referred to within talent research.

2.2.1.2 Theoretical models

Talent-related models within sports science are informed mainly by the field of cognitive psychology and skill acquisition and expertise research. Particularly the work by Bloom (1985) on developing talent in young people, Ericsson et al. (1993) on the role of deliberate practice in the acquisition of expertise, and Côté (1999) on the role of the family in the

development of talent in sport has profoundly influenced talent-related models in sports science (Bruner et al., 2009).

However, there is often no clear differentiation between talent (development) models, career development models, and athlete development models, which all have the similar objective of bringing order and organization into the complex process of development in sports. Within a citation network analysis of seven heavily cited athlete development models, Bruner et al. (2010) identified two subgroups of theoretical models with very little connection between both groups. Such a disconnect is rather surprising since the underlying phenomenon of athlete development is the same (Coutinho et al., 2016).

The first identified subgroup of athlete development models addresses athlete development from a talent perspective. Thus, Bruner et al. (2010) termed these models talent development models (for exemplary models, refer to Abbott & Collins, 2004; Bailey & Morley, 2006; Côté, 1999; Durand-Bush & Salmela, 2002; Morgan & Giacobbi, 2006). Within such models, the athletic career is divided into several stages; for each stage, the changes in athletes themselves, practice characteristics, and their social environment are described. In accordance with the models' origins in the talent and expertise literature, deliberate practice is sought to play a decisive role in becoming an elite athlete. Even though these models are referred to as talent development models (Bruner et al., 2009; Bruner et al., 2010; Coutinho et al., 2016), they are not concerned with the emergence of talent in an individual. Instead, they model the development of an athlete from youth sport participation to senior elite sports by dividing athletic careers into several uniform stages (Coutinho et al., 2016) without offering any explanations on what talent means and entails.

The second subgroup that Bruner et al. (2010) identified subsumes those athlete development models based on the career transition literature. Examples are the work of Stambulova (1994) and Wylleman and Lavallee (2004). Models of this subgroup aim to

describe and explain the demands, coping processes, and consequences of a transition in sport from a holistic perspective on an athlete's career (Coutinho et al., 2016). Both subgroups of theoretical models that Bruner et al. (2010) identified depict athlete and talent development as homogenous, stage-like processes, which represents a serious limitation. Empirical research on talent development trajectories actually shows very idiosyncratic pathways with many factors interacting with each other (cf. Durand-Bush & Salmela, 2002; Phillips et al., 2010).

To address this limitation, talent researchers in sports science have begun to apply theoretical and conceptual ideas from developmental, ecological, and cognitive psychology to the phenomenon of talent development in sports. As a consequence, we find a new group of talent development models in sports science that specifically aim to address the idiosyncratic, interactive, non-linear, and dynamic nature of talent and its development over the life span (MacNamara & Collins, 2014).

Simonton (1999) set the stage for more complex talent models by proposing an emergenic and epigenetic model of talent and its development. For Simonton (1999), talent represents an "innate capacity that enables an individual to display exceptionally high performance in a domain that requires special skills and training" (Simonton, 1999, p. 436). At first sight, this definition does not sound different from previous definitions of talent. However, he goes on and explicates that, according to his model, the innate capacity (which he terms talent) consists of multiple components, which all have to be present for the manifestation of superior performance in a talent domain. However, each of these components has its own distinct epigenetic trajectory, making talent development a highly dynamic and idiosyncratic process (Simonton, 1999, 2001). Consequences of such an emergenic and epigenetic model include (a) a possible lack of early indictors of talent, (b) the exhibition of the same amount of talent at different ages among different individuals, (c)

changes in an individual's apparent talent over time, and (d) a possible loss of talent (Simonton, 2001).

In recent years, talent researchers have further developed Simonton's ideas in that more recent talent models place a greater focus on environmental factors and interactive dynamics among talent-related components (cf. Davids et al., 2015; Phillips et al., 2010). Within dynamic systems models, the performer and the performance environment are conceptualized as complex and dynamic systems. The system's behavior is then characterized by continuous interactions between system components and change across different time scales (Davids et al., 2015; Den Hartigh et al., 2018; Den Hartigh et al., 2016). These dynamic systems conceptualizations of athletic talent offer exciting avenues for future research due to their focus on the dynamic, asynchronous, multidimensional, and interactive nature of talent development.

2.2.1.3 Empirical landscape of talent research

When examining the current empirical landscape of talent research in sports science, we can find clear imbalances concerning the thematic foci of research efforts. A large focus has been placed on perceptual-cognitive skills, making up 25.5% of publications between 1990 and 2018 concerned with talent in sport (see scoping review by Baker et al., 2020). Most empirical talent research in sports employs cross-sectional research designs (68% of papers published between 1990-2018). Consequently, questions on how talent develops over time remain empirically under-investigated despite their substantial theoretical and practical significance.

In the last decade, we can observe an increase in multidimensional and holistic models and approaches to talent development (Seidel, 2011). However, most empirical talent development research primarily focuses on how singular factors contribute to the development of expert performance in sports (Den Hartigh et al., 2018). Examined factors

range from the birthplace effect (e.g., Li et al., 2014) to the relative age effect (e.g., Smith et al., 2018), physiological and physical characteristics of talented athletes (e.g., Rees et al., 2016; Sarmento et al., 2018), psychological factors (e.g., Sarmento et al., 2018), the role of deliberate practice (e.g., Macnamara et al., 2014; Macnamara & Maitra, 2019), and the role of adversity for the developmental pathway (e.g., Howells et al., 2017).

Recently, many researchers have stipulated that high-achievement emerges across the life span according to dynamic person-environment interactions (cf. Den Hartigh et al., 2016; Simonton, 1999). However, in a recent review on the current state of knowledge on the development of sporting talent, Rees et al. (2016) still observe a lack of prospective and multidisciplinary studies that could offer insights into the complex interactions between various factors contributing to the development of expert performance. As a specific candidate for future examination that is under-studied in sports, the researchers identify the impact of positive or negative critical events with high personal significance on the developmental pathway (Rees et al., 2016). Thereby, they follow recent conceptual, highly debated, and often misunderstood papers that suggest that 'talent needs trauma' (Collins & MacNamara, 2012). Despite the controversial nature of such claims, recent approaches within the field of talent development research and practice begin to refrain from making the pathway to expert performance as smooth as possible. Instead, we can see approaches that aim to constructively integrate challenges into the developmental pathway to prepare 'talents' for future 'bumps in the road' to reduce the probability of drop-out during difficult phases of development.

Overall, we can observe a change in research foci from talent identification to talent development within sports scientific talent research (Vaeyens et al., 2008). Future talent research should center around which factors might constrain and facilitate talent development (Abbott et al., 2005; Baker et al., 2017). Since humans have the capacity to influence their

future through processes of decision-making and meaning-making, it appears to be necessary to place a greater emphasis on the individual and his or her interaction with the specific environment in which development takes place (cf. Martindale et al., 2005). Through such a research focus, it might become possible to provide appropriate and stimulating developmental opportunities that allow an individualized approach to talent development (Vaeyens et al., 2008), which remains one of the most important challenges for future talent research and practice.

When we now turn to the field of giftedness research, we soon see the significant overlap with talent research.

2.2.2 Giftedness research

The origin of 'modern-day' giftedness research can also be traced back to Galton's study on the family histories of British men who achieved eminence in various domains (Robinson & Clinkenbeard, 2008). However, the concept of giftedness has its origin in psychological and educational research and has historically been applied to intellectual performance capabilities (cf. Galton, 1869; Terman, 1925). Thus, giftedness is more closely associated with cognitive-intellectual achievements rather than with athletic achievements.

2.2.2.1 Mapping the development of the field

Concerning the field's historical development, we can identify four general waves of giftedness research (cf. Kaufmann & Sternberg, 2008) that differ mainly with regard to how they conceptualize giftedness.

The first wave of giftedness research laid the foundation for the field by asking 'what is giftedness?' (cf. Kaufmann & Sternberg, 2008). In the early 1900s, researchers developed the first cognitive tests to measure giftedness, which was operationalized as general intelligence during this time (Binet & Simon, 1916; Spearman, 1904; Terman, 1916). The well-known, often cited longitudinal study of Terman (1925) on gifted children (here defined

as children with an intelligence quotient above 140) can be attributed to the first wave of giftedness research. With this study, Terman (1925) aimed to dispel the myth that gifted children are maladjusted and emotionally troubled. Indeed, his findings suggest that the children he studied were generally healthier, better-adjusted, and higher achievers than children with lower intelligence quotients (cf. Robinson & Clinkenbeard, 2008).

The second wave of giftedness research in the mid-1900s challenged the assumption that giftedness equals high general intelligence (cf. Kaufmann & Sternberg, 2008). Thurstone (1938), for example, emphasized that various ways in which an individual can be gifted exist. So, rather than associating the term giftedness solely with intellectual and cognitive achievements, researchers of the second wave asserted that multiple, distinct ways to be gifted could be observed (cf. Gardner, 1983).

In the late 1900s to the early 2000s, the conception of giftedness evolved even further. Within the third wave, researchers not only recognized the importance of domain-general and domain-specific aptitudes but also reckoned the importance of other psychological variables such as creativity and commitment (cf. Kaufmann & Sternberg, 2008). In sum, these developments led to the view that giftedness can be conceptualized as a system whose total operation depends on various psychological processes working together (Renzulli, 1978, 2005; Sternberg, 2003, 2005). However, such system conceptualizations of giftedness still focused only on the individual and disregarded the broader sociocultural context.

Consequently, within the fourth wave of giftedness research at the beginning of the 21st century, researchers began to emphasize the constantly changing nature of aptitudes or gifts and placed giftedness within a developmental context (cf. Kaufmann & Sternberg, 2008). Various external factors such as practice conditions, chance, and social support were included in modern conceptualizations of giftedness (Gagné, 1995, 2005), assuming that internal factors interact with external factors during the developmental process.

Summarizing, similar to the described developments within talent research, the focus of giftedness research has shifted towards explaining developmental processes instead of merely listing static traits (Dai, 2019; Güllich, 2013; Kaufmann & Sternberg, 2008). The described developments in the field of giftedness research are also reflected in the theoretical models.

2.2.2.2 Theoretical models

We can identify four categories of giftedness models that aim to explain the "movement from potential to accomplishment" (Subotnik et al., 2011, p. 29).

The first category includes theoretical models that are based on variables associated with giftedness. However, these variables are not placed within a trajectory; rather, such models (for example, the Wisdom, creativity synthesized model by Sternberg, 1998; or the co-incidence model by Feldman, 1986) indicate how each included variable on its own is necessary but not sufficient to maximize potential (Subotnik et al., 2011). Thus, such models belong to the more static trait accounts of giftedness.

The second category of models features trajectories in which components of giftedness are placed into a sequence (for example, the enrichment triad model by Renzulli, 1977; or the Differentiated Model of Giftedness and Talent (DMGT) by Gagné, 1995). Therewith, this class of models takes a step closer to process accounts of giftedness; however, the sequence itself is not explicitly framed as a developmental process and does not feature developmental changes over time (Subotnik et al., 2011).

Within giftedness models of the third category (for example, Bloom's (1985) model; or the scholarly/artistry model by Subotnik & Jarvin, 2005), we can observe developmental changes over time in that the variables included in the models change in importance depending on the developmental stage (Subotnik et al., 2011).

The fourth category of giftedness models includes systemic models. Instead of conceptualizing giftedness solely as a characteristic of the individual, Ziegler and Phillipson (2012) offer a systemic conception of giftedness with their actiotope model of giftedness. This model construes giftedness as a dynamic complex consisting of the individual, the environment, and their interactions (cf. Güllich, 2013; Subotnik et al., 2019; Ziegler & Phillipson, 2012). Instead of simply dividing giftedness into measurable components, systemic approaches focus on the contextual organization of components. As social beings, humans have to constantly adapt to their sociotopes (i.e., their environments); a person's characteristics and behaviors can be thought of as the result of a successful adaptation to the respective environment (Ziegler, 2005; Ziegler & Phillipson, 2012). According to Ziegler and Phillipson (2012), 'gifted' individuals stand out against other individuals in their ability to constantly perform with high levels of competency within their unique environments.

With regard to giftedness models in general, we can again observe a lack of terminological clarity concerning the key terms of talent and giftedness. One of the notable exceptions in this regard is Gagné's Differentiated Model of Giftedness and Talent (DMGT) that he first described in 1995 (Gagné, 1995) but further developed over the following years (Gagné, 2010). In his 1995 paper, Gagné critically examined the current use of the terms giftedness and talent in research and heavily criticized the ambiguity over the definition of central concepts in the field of giftedness and talent research. He noted that both terms refer to human abilities, often intellectual ones, but also artistic, musical, or athletic abilities. Behind both terms also lies a normative meaning, in that they denote ability or performance levels above the population average (Gagné, 1995). To delineate both terms, Gagné set out to differentiate between natural abilities and systematically developed abilities. The DMGT model depicts the developmental process from natural abilities, which Gagné termed 'gifts', to systematically developed abilities (or competencies, see Gagné, 2009), which he termed

'talents'. Giftedness was then operationalized as the "possession and use of untrained and spontaneously expressed natural abilities (aptitudes or gifts) in at least one ability domain" (Gagné, 1995, p. 106), placing the child's or adult's achievements among the top 10% in a given field (Gagné, 2009). Talent was operationalized as the "superior mastery of systematically developed abilities (skills) and knowledge in at least one field of human activity" (Gagné, 1995, p. 107), again placing the child's or adult's achievements among the top 10% (Gagné, 2009).

Therewith, the DMGT model is one of the very few conceptions of giftedness that offers a clear definition of the two key concepts in the field of giftedness research and gifted education. While Gagné himself often proposed to apply his model to the field of sports, it has barely received attention within sports scientific talent research (Tranckle & Cushion, 2006). Instead, the DMGT and its updates have mainly been adopted in giftedness research.

2.2.2.3 Empirical landscape of giftedness research

Overall, the field of giftedness research can be characterized as fragmented and contested, rather than unified, lacking a coherent set of research agendas and a widely accepted methodology and terminology (Dai et al., 2011; Ziegler & Raul, 2000).

Dai et al. (2011) conducted a review on the state of empirical research on giftedness and gifted education that included 1234 articles published between 1998 and 2010. As the review illustrates, the predominant mode of investigation during that period was quantitative, making up three-quarters of the total research conducted within the field. While quantitative research was mainly psychosocial in nature, qualitative giftedness research was more clinically oriented with a greater connection to educational rather than psychological research. With regard to the domain or subject category, art/music and mathematics were studied most frequently. The central research topics accounting for almost half of the published studies were creativity, achievement and underachievement, identification of

giftedness, and talent or talent development (Dai et al., 2011). As Olszewski-Kubilius and Thomson (2015) indicate, giftedness researchers tend to employ the concept of talent development (and not *giftedness* development) to refer to a particular framework within giftedness research in which giftedness is described as a potential that is then developed into competence and expertise (Olszewski-Kubilius & Thomson, 2015). Here, we can already see that a clear differentiation between talent and giftedness research might be difficult to uphold.

Overall, many factors have been identified and discussed as contributors to giftedness and its development (Subotnik et al., 2011). Frequently studied contributors include creativity (e.g., Sriraman et al., 2013), motivational constructs (e.g., Dai et al., 1998), personality (e.g., Limont et al., 2014), emotional trauma (e.g., Simonton, 1994), parents (e.g., Simonton, 1997), and chance and opportunity (e.g., Hertzog, 2009). The role of practice and innate ability for giftedness represent the most contested issues within the field (Subotnik et al., 2011; Winner, 2000), reflecting the still ongoing impact of the nature-nurture debate on giftedness research. In their monograph, Subotnik et al. (2011) take a deep look at the current state of research with regard to the central questions whether high ability is necessary for outstanding performance, and whether differences in ability are innate. They come to the conclusion that high levels of general ability are necessary but not sufficient for excellent performance to occur. Concerning the innate nature of such abilities, most current theorists agree that abilities stem from genetic and environmental components that likely interact in modifying abilities over developmental time (Subotnik et al., 2011).

During the last 20 years, several conceptual and programmatic papers in the field of giftedness research (e.g., Dai, 2019; Dai & Renzulli, 2008; Olszewski-Kubilius & Thomson, 2015; Plucker & Barab, 2005; Preckel et al., 2020; Subotnik et al., 2011) have also issued a call for more context-specific perspectives in giftedness research. In traditional conceptions of giftedness, giftedness has been viewed as a construct residing within the individual. Thus,

most research attention has primarily been placed on the individual (Plucker & Barab, 2005). However, all achievements occur within a specific sociocultural context, which represents a prerequisite for determining whether and how an individual or action will be defined as gifted (Plucker & Barab, 2005; Subotnik et al., 2011). As a consequence of such deliberations, contextual, dynamic, and emergent perspectives on giftedness are increasingly found within giftedness research. Proponents of such perspectives emphasize the importance of interactions with the environment and the timing of certain experiences for developmental pathways (Dai & Renzulli, 2008). This view is in line with recent theoretical developments within developmental psychology. Here, complex systems (such as gifted or talented individuals) are conceptualized as being interaction-dominant rather than component-dominant, meaning that multiple components interact in driving developmental changes (Dai, 2019).

Despite these theoretical developments that emphasize the complex and dynamic nature of developmental processes, very recent programmatic papers such as the one from Preckel et al. (2020) still suggest talent development frameworks for giftedness research that focus solely on person-related psychological variables. To justify such a narrow perspective, the respective authors state that the inclusion of environmental and genetic factors would make their framework too complex to be empirically testable (Preckel et al., 2020). However, in line with calls within talent research in sports science (Martindale et al., 2005; Rees et al., 2016; Vaeyens et al., 2008), it might be time to embrace such complexities rather than disregarding them for the sake of empirical testability.

2.3 Research Gaps and Research Desiderata

In summary, talent and giftedness research share a common historical origin; the conceptual definitions of both terms are comparable, the development of the respective research field,

their research agendas, and the employed theoretical models are very similar. It should further be noted that the concept of talent development (and not *giftedness* development) represents a central topic within giftedness research that also often refers to 'talented *and* gifted individuals'. Due to the significant overlap of talent and giftedness research and the joint use of the concept of talent development, hereafter, I no longer differentiate between both terms within the dissertation but will solely use the term talent, with giftedness being subsumed under this term.

As discussed in the previous sub-chapters, research on talent and its development has been dominated by the nature-nurture debate since its beginnings in the 19th century. As a consequence, the field of talent research has become polarized and fragmented, which hinders progress at the theoretical, methodological, and empirical level (Tranckle & Cushion, 2006). In the following, I deduce the most important research gaps and identify theoretical, methodological, and empirical desiderata for future talent research.

2.3.1 Theoretical desiderata

On a theoretical level, a theoretical framework that considers the multidimensional, asynchronous, and dynamic development of talent in a specific context is still lacking. Most current theoretical frameworks within the realm of talent development still focus solely on modeling performance development. Such approaches disregard that the process of talent development cannot be disconnected from other spheres of life. Current 'holistic' talent development models (e.g., Wylleman & Rosier, 2016) aim to address this shortcoming. These models do not only consider performance development but also integrate other aspects such as academic or personality development when depicting the talent development process. From a theoretical point of view, most holistic models still suggest that factors important for development can be clearly delineated and attributed to specific aspects of development (such as psychological, social, or academic aspects of development).

Thus, most theoretical approaches within talent research do not consider the interaction of factors, even though interactive dynamics lie at the heart of current theoretical approaches in other fields within the realm of human development (such as developmental psychology). We can observe some progress in this regard with recent dynamic systems conceptualizations of talent in sport (e.g., Balague et al., 2013; Phillips et al., 2010; Seifert et al., 2018). A drawback of dynamic systems approaches within the context of talent and its development is their narrow focus on the acquisition of motor skills and the immediate performance environment, not taking into account the broader sociocultural context in which human development occurs. In addition, in most dynamic systems conceptualizations of talent, it remains unclear what the 'system' and what the 'environment' entails precisely. Sometimes, even within the same paper, both the performer him- or herself and the interaction between the performer and the environment are conceptualized as a system. Thus, recent talent-related dynamic systems approaches within sports science are incoherent in their use of terminology, particularly with regard to the system concept, so that further theoretical work is required.

Furthermore, a clear conceptualization of how external influences affect the individual and the developmental processes is missing. From a life span perspective, life events constitute such external factors and play a key role in human development. Within the specific area of talent development, life events have only been scarcely considered. In some earlier conceptualizations of talent development (such as in Gagné's DMGT), life events appear as 'chance' factors but have not attracted much research attention for quite a while. It remains unanswered how life events might be processed by the individual and subsequently influence talent development. With the current 'talent needs trauma' debate, initiated by Collins and MacNamara (2012), the concept of 'trauma' has experienced a revival within sports scientific work on talent development. However, clear theoretical conceptualizations of

critical life events and their significance for (talent) development are still lacking. This might be due to their close association with chance and arbitrariness. However, every human being will encounter critical life events during his or her life course; thus, we cannot completely neglect them in the context of talent development. If we do so, we risk disregarding the complexity of human development for the sake of simplicity. “Embracing this complexity remains the most obvious future direction” (Rees et al., 2016, p. 1050) for the field of talent research.

2.3.2 Methodological desiderata

While dynamic and multidimensional conceptualizations of talent have begun to evolve at a theoretical level, we mostly observe methodological approaches that do not match the respective theoretical assumptions. Bergman and Andersson (2010) refer to a problem-method mismatch with regard to developmental psychology, but their observations can also be transferred to talent research. With regard to the methodological approaches used in talent development research, variable-oriented approaches dominate. Such approaches usually gather individual variables at one point in time and correlate these with performance measures at later time points to identify performance predictors. Such population-based, variable-oriented methodological approaches do not take the dynamic and multidimensional nature of modern conceptualizations of talent into account (Zibung, 2010).

To achieve a better match between theoretical conceptualizations of talent and methods used, methodological approaches that do justice to the interactive and dynamic nature of talent development (Coutinho et al., 2016) and the individuality of developmental pathways are required. In this regard, Güllich (2013) suggests a person-oriented approach that has its roots in developmental psychology as an alternative to a variable-oriented methodological approach within talent development research. Nearly all person-oriented approaches build their methodological procedures on the assumption that individuals are

unique but that it is still possible to identify a relatively small number of typical patterns among individuals (von Eye & Bogat, 2006). Within person-oriented approaches, the individual is regarded as an integrated totality over time and not as the sum of variables over time – as would be the case in variable-oriented methodological approaches (Bergman & Trost, 2006). Thus, the objective of person-oriented approaches is to capture the idiosyncratic nature of developmental processes (Preckel et al., 2020), allowing us to better understand how contextual factors contribute to talent development.

As Tranckle and Cushion (2006) observe for sports scientific talent research – but what can also be said for the field of giftedness research – studies rarely analyze the experiences and insights of the most important individuals within the talent development process, namely the performers themselves and significant others. Investigating their perspectives and experiences might help in understanding and improving the processes of talent identification and development. However, such investigations require methodological approaches that capture subjectivity and help understand how talent is perceived by those to whom we attach this label. Perceptions and beliefs about talent matter (Baker et al., 2017); they can have real and powerful effects on development. Thus, within talent research, we also need interpretive approaches that can capture the subjectivity of participants (Tranckle & Cushion, 2006). In order to apprehend developmental processes retrospectively, narrative approaches might be fruitful. However, the biopsychosocial nature of talent development (cf. John et al., 2020) can hardly be grasped with traditional narrative interview approaches. Thus, there is also a need for the further development of existing methodological approaches that would allow to capture the full complexity of biopsychosocial developmental processes that can be observed with regard to talent development.

2.3.3 Empirical desiderata

Based on the described gaps on a theoretical and methodological level, we can identify several desiderata for empirical talent research.

Little is known about the life courses of high-achievers, what challenges, events, or experiences they have encountered, and how these may have shaped their talent development pathways (Peterson et al., 2011). Questions such as (a) how high-achieving individuals perceive internal and external demands, (b) whether various talent development trajectories are characterized by typical critical experiences, (c) when critical experiences need to occur, (d) which resources and coping strategies high-achieving individuals perceive as useful when encountering critical life events need to be answered within talent research (Seidel, 2011; Subotnik et al., 2011). Instead of treating life events and experiences as chance factors, they should be treated as essential components of the talent development process (Subotnik et al., 2011) and researched systematically.

For investigating such questions, it is necessary to consider that talent development is always part of human development and cannot be compartmentalized. In this regard, empirical talent research could be better informed by developmental theories and socialization theories, keeping in mind that factors relevant for talent development cannot be considered independently of other life contexts. Therewith, research should be informed by a very differentiated perspective taking into account both the individual's life world and characteristics of the individual, including his or her unique history of experiences.

Following through, a significant limitation of current empirical talent research lies in the implicit assumption that we just need to identify the 'right' variables to predict performance and the 'right' factors that optimally support development; and then, the achievement of high performance is guaranteed. Such an assumption disregards that individuals are constructors of their own development. They meaningfully process external

inputs (such as support strategies, practice conditions, or life events) against the background of previous experiences. However, we do not know much about which factors high-achieving individuals themselves retrospectively consider relevant for their own development. As a result, one highly fruitful source for talent research, namely the high-achievers' own construal of relevant parameters for their success, is basically neglected.

Closely related, there is also a dearth of research on 'beliefs' about talent among those who we label as talented. Their attitudes, perceptions, and beliefs about talent can impact their motivation, behavior, and ultimately their performance (Baker et al., 2017). For instance, if an individual believes that abilities are developable with practice and effort, the motivation to practice, the willingness to apply effort, and the productive use of failure will be more likely compared to an individual who perceives abilities as innate and ultimately unchangeable. However, this is not only a phenomenon at the individual level but also at the societal level in terms of talent identification, talent development, and talent support strategies. Research investigating implicit assumptions and meanings with regard to talent and developmental processes at an individual and societal level is an avenue for future research.

Last but not least, research across several achievement domains with the same research questions and methodologies also holds potential for the field of talent research. The underlying phenomenon – the development of high-achievement – is basically the same within each achievement domain. Such comparative research needs to be informed by domain-specific knowledge on the specific characteristics of each achievement domain, such as different ages at peak performance (see Subotnik et al., 2011). Then, it has the potential to disentangle domain-specific and domain-general factors in the development of high-achievement. Particularly, sports scientific talent research could lead the way in this regard. Compared to the state of giftedness research in which giftedness is still frequently

operationalized as intelligence, talent – despite all terminological and conceptual ambiguities – is rather widely and dynamically conceptualized within sports science.

3 A Social Constructivist Perspective on Talent and its Development

Talent development is a multidimensional phenomenon in which 'the social' and 'the personal' interact. On the one hand, the person considered talented has to fit or has to be made fit to the specific achievement context, but, on the other hand, the respective achievement context also has to fit or has to be made fit to the person. The question of 'fit' between person and context and how such 'fit' might evolve along the developmental pathway has scarcely been focused on within previous talent research. Most research employs a rather narrow personal understanding of talent development in which the context – as experienced and 'constructed' by the developing individual – is marginalized. Structural conditions of the respective achievement context and the individual's life world, meaning the "world as immediately or directly experienced in the subjectivity of everyday life" (The Editors of Encyclopaedia Britannica, 1998), are disregarded. In this regard, it is also important to acknowledge that a person is more than the talent-related factors deemed important for success in the respective achievement domains. Individuals have very different stories; they make very different experiences in different spheres of life, which all shape their identities, developmental pathways, and how they adapt to the structural conditions and demands of the respective achievement context. To capture such complex interactions between 'the personal' and 'the social' with regard to talent development, I use a social constructivist paradigm as the epistemological basis for my deliberations within this dissertation.

Social constructivism has two basic assumptions. First, we cannot know how reality 'really' is; for us, there is no 'objective' reality. Instead, reality is dependent on the observer and, therefore, multiple (cf. Luckmann & Berger, 1966; Pörksen, 2014). Second, the reality that humans experience as 'real' is the result of a construction by themselves in interaction with their environment. This does not mean that there is no external reality, but what we

know about the world and how we perceive the world is largely dependent on being part of a specific historical, cultural, and social life world. Social constructivism assumes a dialectical relationship between reality-constructing individuals and socially constructed reality (Luckmann & Berger, 1966).

Such an understanding of reality also has repercussions for the scientific process. On the one hand, research plays a role in constructing reality; on the other hand, it is itself the result of social construction processes. Researchers are also part of a socially constructed reality; they cannot act as 'outside observers' but are always entangled within their own constructions of reality (von Foerster, 1992). Instead of aiming to directly represent social reality, social constructivist research focuses on social processes that produce such reality constructions (Hejl, 1992). Social constructs are socio-culturally derived concepts that reflect a mutual understanding of things, actions, events, and social phenomena (Lo et al., 2018). Thus, research conducted within a social constructivist paradigm does not aim to offer a 'true' representation of reality but instead asks (i) how social reality is constructed, (ii) how individuals experience their everyday life in terms of a world of experiences, (iii) how humans name phenomena in their environment, and (iv) what consequences such processes of knowledge construction have (Richter, 2016).

From a social constructivist viewpoint, the focus shifts away from assessing whether a construct corresponds to reality (Hejl, 1992). Instead, central questions are how a construct is created through communicative processes within society and how individuals experience a construct as 'real' and 'objective' (Richter, 2016).

3.1 Talent as a Social Construct

Social constructivists propose the three processes of *institutionalization*, *objectification*, and *legitimation* (Richter, 2016) to elucidate how social constructs are formed and perceived as

'real'. These three processes can also be observed in the context of talent identification and development. *Institutionalization* practices lead to behavioral expectations; such behavioral expectations are part of particular social roles (cf. Parsons, 1968). Within talent development programs, social roles such as mentor and mentee (or 'talent') are assigned. These social roles go along with certain expectations on how the individual – to whom a particular role is ascribed – is supposed to act (for example, demonstrating continuous motivation through hard work and effort). When individual experiences within a certain social context are communicated repeatedly, *objectifications* occur (cf. Luckmann & Berger, 1966). So, if, as part of talent development strategies, it is suggested again and again that those 'talented' individuals who achieved great success specialized very early, such individual experiences will become part of the stock of knowledge and will be generalized. Through further *legitimation processes*, such as setting age-specific performance criteria that require early specialization and that determine whether an individual becomes part of an institutionalized talent development program, objectifications are justified, and the joint stock of knowledge is assured and stabilized (cf. Luckmann & Berger, 1966; Richter, 2016).

According to Csikszentmihalyi et al. (1993), talent is a "label of approval we place on traits that have a positive value in the particular context in which we live" (p. 23). In other words, we can assert that talent can be thought of as a social construct derived from interactional communicative processes within a particular sociocultural environment. The attribution of talent is relative to a given social context; what we perceive as talent is largely impacted by the performances of current high-achievers. Their physical and mental characteristics implicitly shape who we identify as talented. Due to changes in rules, tactics, or the taste of the audience, the patterns of characteristics that promise success might also change. As a consequence, who we perceive and label as talented will also change. Thus, the

attribution of talent is embedded within a specific, historically changing social context (Morelock, 1996).

The assignment of talent to an individual often resembles a self-fulfilling prophecy since the construct of talent comes with expectations, assumptions, and beliefs about future events that can have a 'reality-creating' power (cf. Watzlawick, 1992). Within the sociology of success, the so-called *Matthew effect* (cf. Merton, 1968) aims to explain the 'reality-creating' power of the assignment of talent to an individual. By placing this label of approval on a person who displays an above-average level of ability, the person attracts attention within an institutional setting, which often leads to increased support. Through support measures, the person likely succeeds against those individuals who do not receive any support and, in turn, benefits from ongoing and even more support. The Matthew effect refers to such positive feedback loops, which can eventually lead to an accumulated advantage; slight differences in actual abilities might have huge effects later on (cf. Merton, 1968). Consequently, whether an individual gets the opportunity to realize his or her potential depends on a social context. Only if the individual's characteristics are recognized as valuable and promising for future success within the respective social context, institutional support mechanisms will be offered (cf. Smith, 2001). The individual him- or herself, in turn, is expected to take over the social role (i.e., talent) ascribed to him or her.

Following this line of thought further, the context-specific nature of talent and its development requires a differentiated examination of the respective life worlds in which talent development takes place. Within these life worlds, ideas and meanings concerning talent evolve, are communicated, and jointly constructed. These meanings not only determine who will be identified as talented and receives support; they also shape expectations on how individuals considered talented are supposed to act and develop and when certain developments and transitions should occur within the talent development pathway.

3.2 The Life Worlds of Individuals Considered Talented

Within the social sciences, and particularly within sociology, the concept of the life world denotes the world as subjectively perceived and experienced by the individual (Kraus, 2006); so, in the first place, the life world is the subjective construction of a given reality that the subject can never fully grasp (Kraus, 2006). However, within the life world, we also find inter-subjective 'facts' (cf. Costelloe, 1996) – culturally communicated expectations and behavioral norms that the individual adopts through socialization processes. Hence, on the one hand, the life world is unique to each individual and constituted through personal, subjective constructions of experiences. On the other hand, individual experiences are embedded within a net of collective experiences that, in turn, allow opportunities for mutual understanding. Thereby, the life world also becomes an inter-subjective field (Luckmann & Schütz, 1975). This tension between collective and individual experiences within the life world (Costelloe, 1996) can also be observed in the context of talent development. On the one hand, talent development is a process of idiosyncratic and very individual experiences. On the other hand, it is also a process for which collective, inter-subjective expectations can be observed, such as cultural norms on normative and non-normative (talent) developmental pathways or societal ideas about talent (e.g., 'talented individuals have everything going their way and do not need further support'). According to Carlson (1993), the socialization into the particular culture represents an important determinant of success in any sport (Williams & Reilly, 2000), and, as we can add, in any performance domain.

In the public discourse, the term talent is mostly associated with the domains of sports, music, and mathematics. They constitute the classical, traditional achievement domains with the most socio-culturally transmitted expectations with regard to talent and its development (cf. Subotnik et al., 2011). In the following, I discuss the inter-subjectively shared characteristics, talent-related expectations and norms, and the specific pressures within

the life worlds of elite athletes, professional musicians, and mathematicians. Whereas such sociological reflections on the life world of elite athletes can be found in the sports scientific literature, it is rather difficult to find similar reflections on the life worlds of musicians and mathematicians.

3.2.1 The life world of elite athletes

The life world of elite athletes has a highly complex structure (Seidel, 2011) with tensions between a number of social systems (such as the education system and the elite sports system) in which the elite athlete is embedded. From a systems theoretical perspective, elite sports is conceptualized as a social system with its own specific systemic logic of win vs. lose (Schimank, 1988b).

Within the elite sports system, athletes play a key role. They want to win against other competitors, for which they are deeply reliant on their bodies. However, the human body has its physiological limits, so that each athlete's maximum performance capability is limited. Therewith, the body represents the most important resource for the athlete, restricting the possible duration of an athletic career (cf. Wylleman & Reints, 2010). To have at least the chance to succeed against competitors within the limited time frame of an athletic career, athletes have to commit their lives completely to their athletic pursuits, which inevitably leads to a neglect of other life goals and resources such as friendships, education, or a permanent place of residence (Bette et al., 2002). However, all these sacrifices do not guarantee success since the probability of success is very low. Thereby, engagement in elite sports often leads to a high-cost-high-risk situation for athletes.

As a consequence, all other contexts of life have to be aligned to the demands of elite sports. Often, the person's identity becomes deeply entangled with the role of the athlete, leading to an athletic identity at the cost of other identity options; in other words, the role of the athlete becomes *totalized* (Bette et al., 2002). Such processes of *identity foreclosure*

(Brewer & Petitpas, 2017; Brewer et al., 1993) often begin at biographically early points in time, particularly when a young athlete has the potential for world-class performances. In sociology, the term *hyperinclusion* is used to describe the phenomenon where one social system takes precedence over all other social systems in a person's life (cf. Göbel & Schmidt, 1998; Thiel et al., 2013). Elite athletes devote all their lives to elite sports; they become *hyperincluded* into the sports system, entering a downright 'life trap' with fewer and fewer exit options (Thiel, Renner, et al., 2018).

Bette et al. (2002) use the term *biographical trap* to refer to these biographical dynamics within a career in elite sports. The risk to enter a biographical trap increases the more irreversible the choice of a certain pathway is and the more uncertain such a pathway is. Due to the uncertainties of an athletic career and the *greedy* nature of elite sports (Bette et al., 2002) with its implicit demand that all individual resources are devoted to athletic pursuits, the risk of entering a biographical trap is structurally installed within the biographies of elite athletes. Being *biographically trapped* is usually the endpoint of a dynamic that begins very early in one's biography through so-called *biographical fixations* (Bette et al., 2002). The athlete's biography becomes more and more narrow through fixations at the temporal, factual, and social level that amplify each other. At the temporal level, athletes have to invest more and more of their time resources in an attempt to reach the top level even earlier, where they will stay shorter and shorter due to the high competition in today's world of elite sports (cf. Haut et al., 2016; Heinilä, 1982). To be able to invest the required time resources, at the factual level, athletes shift their life priorities towards sports, which in turn increases the sport's subjective importance for the athlete. Due to changes in priorities, at the social level, athletes tend to neglect social networks outside of sports. Most of their social contacts happen within sports, which further strengthens their athletic identity. Due to the increasing amount of biographical investments along the talent development pathway, it becomes more and

more difficult for athletes to leave elite sports when, for instance, serious injuries jeopardize their long-term health (cf. Bette et al., 2002).

Due to the described biographical dynamics and the nature of elite sports in which athletes are deeply reliant on the functionality of their bodies, the topic of health deserves particular attention when discussing the life world of elite athletes. On the one hand, health is an important prerequisite for athletic success. On the other hand, elite athletes have to be willing to constantly risk their health when they push themselves to their physical and mental limits in training and competitions. In this context, the socially transmitted *culture of risk* constitutes an essential element of the life world of elite athletes (Nixon, 1993; Thiel et al., 2013). Within this culture, athletes accept health problems, injuries, and pain as necessary byproducts of elite sports. Therewith, the culture of risk is closely connected to the values of elite sports, such as perseverance and a high pain tolerance (Hughes & Coakley, 1991). These cultural norms on the handling of pain and injuries are transmitted through sport-specific socialization processes within the life world of elite athletes (Nixon, 1993). Particularly, the phenomenon of *playing hurt*, which means participating in competitions despite pain, injuries, or sickness, exemplifies the culture of risk in which pain and injuries are trivialized, often ignored, and sometimes even glorified (Thiel et al., 2010).

To sum up, the life world of elite athletes is characterized by structurally embedded biographical dynamics, role expectations, and a specific culture with regard to the handling of the most important resources of the athlete, his or her body and health. Within the elite sports system, objective criteria to judge performances exist. Consequently, elite athletes can formulate their ultimate goals in terms of winning; this point differentiates the life world of elite athletes from the life worlds of high-achievers in other performance domains.

3.2.2 The life world of professional musicians

The life world of musicians is characterized by the paradoxical situation that the music system's logic of action remains unclear. There is no agreed-upon binary code for the music system, which is often subsumed under the art system in Luhmann's systems theory. We could think of the code 'beautiful vs. ugly' for the art system. However, in contrast to the commonly established code 'win vs. lose' within the elite sports system (Schimank, 1988b), such a distinction is difficult to uphold since clear 'objective' criteria according to which something can be judged as 'beautiful' or 'ugly' are lacking within the music system. As a consequence, for musicians, it remains quite difficult to formulate their goals solely in terms of winning. In the beginning stages of a musical career, 'winning' might actually be a goal if we think of music competitions such as 'Jugend Musiziert' in Germany; however, during later stages of a musician's career, success in competitions becomes less and less important. Instead, music is a cultural field that stresses music for music's own sake (cf. Pinheiro & Dowd, 2009). Within the music system, aesthetic concerns are elevated over business concerns; critical success (such as recognition by peers) outweighs the importance of commercial success. In the realm of classical music, performers seek to capture the intention of the composer as conveyed in his or her notation as closely as possible; in the realm of jazz music, performers aim to perfect their improvisational skills (Roy & Dowd, 2010).

Like athletes, musicians have to devote large parts of their lives to music-making from an early age; for musicians engaged in Western art music, systematic music instruction often begins between five and seven years of age (Preckel et al., 2020). The talent development process, particularly of classical musicians, is relatively traditional (Subotnik et al., 2019). Music conservatories are often rich in traditions that span decades or even centuries; their students are expected to be deeply devoted to their art and teachers (Subotnik et al., 2011). The choice of a teacher that matches the student is believed to be one of the

most significant decisions in a musical career (Subotnik et al., 2019). During childhood and adolescence, as a consequence, parents are often willing to invest large sums of money into music lessons with renowned teachers and expensive instruments (Bastian, 1986). Thereby, young musicians might feel immense pressure to perform well to justify their parents' financial investments.

However, similar to an athletic career, a musical career is filled with uncertainties and biographical risks. Music is a field in which relatively few dominate who also receive a disproportionate share of resources and opportunities (Pinheiro & Dowd, 2009). However, very few opportunities exist to make a successful living as an instrumentalist, with often inconsistent income and work (Chong, 2021; Pinheiro & Dowd, 2009). To have at least the chance to work as a professional musician, musicians usually have to specialize; among classical and jazz musicians, the devotion to a single instrument is common and rewarded (Pinheiro & Dowd, 2009). However, according to Faulkner (1983), specialization can become a ‘trap’ that prevents taking careers in new directions. This is because employers rarely evaluate musical skills; rather, they tend to use past work as a metric for hiring. As a result, employers typecast musicians to one or few genres based on what they have done previously and not on what they would be capable of (Pinheiro & Dowd, 2009). These deliberations resemble work within sports sociology that refers to the concept of the *biographical trap* to illustrate how the life paths of athletes become more and more constricted through their sole focus on sports (Bette et al., 2002).

In contrast to sports, within the field of music, there are many other professional career options, so that changes in career focus are somewhat common in musical careers (Preckel et al., 2020). Despite being a typical occurrence within musical careers, such changes in career focus are not necessarily easy for the musicians themselves. Often, the work as a professional musician becomes central to one’s identity and self-image, echoing

remarks by Brewer et al. (1993) on processes of identity foreclosure with regard to elite athletes. Also, for most musicians, music is their life, and they define themselves according to their instrumental specialty (Bastian, 1986; Bennett, 2009). Their instrument is often experienced as an extension of their body (Alerby & Ferm, 2005; Bastian, 1986); thus, similar to sports, the body also plays a major role within the domain of music.

Playing an instrument can be a source of passion but can also be physically taxing on the human body through atypical postures, techniques, or embouchures (Park et al., 2007). Acute injuries attained while playing music are rare; rather, injuries are often caused by chronic imbalances between load and load-bearing capacity and through overuse and misuse (Bosi, 2017). The career prevalence of so-called playing-related injuries in adult musicians is estimated between 39% and 87% (Park et al., 2007). Playing-related injuries can jeopardize the careers of musicians and are often emotionally devastating for the affected musicians who might experience a loss of personal identity when being unable to play their instrument (Guptill, 2011). Despite the potential of severe consequences, musicians are often reluctant to seek help; most opt to play through pain since taking time away from their instrument does not represent a viable treatment option from their point of view (Bosi, 2017; Park et al., 2007). Musicians' desire to improve is believed to contribute to their willingness to push their physical and bodily boundaries (Bosi, 2017), to ignore persistent pain (Roy & Dowd, 2010), and to normalize the injury risk (Park et al., 2007). Therewith, music might be another example of the *culture of risk*, a concept that has so far only been used to describe the specific culture within elite sports. Within the life world of musicians, socialization processes into this way of handling pain begin quite early. According to Park et al. (2007), 35% of youth orchestra members aged nine to 15 believe that it is acceptable to play with pain, echoing recent studies with adolescent elite athletes (Mayer et al., 2018; Thiel et al., 2017).

Thus, musicians and athletes are both socialized into the respective ‘performance culture’ at biographically early time points. Talent identification and development programs and competitions begin at an early age, which can also be observed in mathematics (cf. Subotnik et al., 2011).

3.2.3 The life world of mathematicians

More than athletes and musicians, mathematicians are confronted with several stereotypes within their life worlds. This often begins as soon as the child or adolescent displays the first signs of high mathematical literacy. Already elementary school children have presuppositions against mathematicians; when they are asked to talk about their associations related to mathematicians, they describe them as males who have no friends, are not married, and have no social life (Wilson & Latterell, 2001).

Analyses of the construction of mathematicians and mathematics in popular culture reveal particular and sometimes contradictory meanings and discourses (Epstein et al., 2010). Despite depicting mathematicians as members of dominant groups in relation to gender, race, class, and sexual orientation, the “figure of the mathematician is still ‘othered’” (Moreau et al., 2010, p. 29). Mathematicians in popular culture are represented as nerds or geeks with no social skills and fear of all human things; the theme of mathematicians who have a mental illness is also common (Epstein et al., 2010; Mendick, 2005; Moreau et al., 2010; Wilson & Latterell, 2001). Such images clash with how mathematics is represented within popular culture; mathematics is depicted as hard, logical, certain, and ultra-rational (Epstein et al., 2010). Students often draw on these images in constructing their own identities (Epstein et al., 2010; Moreau et al., 2010). In the students’ own narratives and in popular texts, being a mathematician is rarely an accidental aspect of someone’s identity; instead, all other aspects of identity are often influenced and dominated by that particular aspect (Moreau et al., 2010).

Particularly in adolescence, when the integration into a peer group is one of the key developmental tasks, students who are highly able in mathematics are confronted with opposing pressures. When they perform to their true potential, they often experience bullying; when they perform lower on tests on purpose, they might be more accepted by their peers (Boehnke, 2007). Mathematically able girls often face additional pressures rooted in gender norms. Within the current sociocultural discourse, mathematical ability is socially constructed as natural, individual, and masculine. Cultural stories portray mathematicians as active and independent thinkers who shape their own paths and achieve success in the end. Thus, cultural stories on mathematicians depict separated rather than connected ways of interacting with the world, which is believed to be more masculine than feminine (Mendick, 2005). Thus, choosing mathematics creates an additional tension for women as identification with mathematics can question their feminine identity (Boaler et al., 2011).

For adult mathematicians, who pursue a career in academia, characteristics of the life world of academics are worth considering. In general, the binary code of the system of science is ‘truth vs. untruth’ (Luhmann, 1990). Within science, the fundamental goal is to achieve a monopoly on ‘correct’ science (Bourdieu, 1975); scientific competence can be seen as a socially recognized capacity to represent one’s discipline in scientific matters. However, within science, recognition, which is the profit in the field, is granted by other researchers, who are also competitors, making them least inclined to give recognition to another researcher. Thus, scientists are one another’s competitors and judges at the same time (Bloch, 2002). Such constellations have implications for the culture of academia; to meet the demand of academic culture to demonstrate control and authority, researchers often play a ‘deceiving game’ (Bloch, 2002) in which everyone pretends to have confidence and control about their research.

Similar to athletes, competition is common among scientists and results from individuals competing for scarce and finite resources, such as "priority, influence, prestige, faculty positions, funding, publications, and students" (Anderson et al., 2007, p. 438). In this current competitive system within modern-day universities, young scientists are often played off against each other for increasingly scarce attractive career opportunities. The number of highly educated and trained researchers often far exceeds the need, a point described as the 'postdoc bottleneck' (Anderson et al., 2007). These dynamics have also become a major point of critique among German academics in recent debates on the precarious and uncertain working conditions of postdoctoral researchers (Bahr et al., 2021). Thus, academic careers often resemble a gamble; 'failure' typically comes with high personal costs due to the close connection of one's identity with being a researcher and the biographical fixations that an academic career requires (Beigi et al., 2018; Preckel et al., 2020).

Like elite athletes and professional musicians, academics face a high number of pressures within their life world; they are expected to obtain external grants, do work of practical relevance for society, and publish consistently and efficiently. The sociologist Wilson (1942) coined the term *publish-or-perish culture* for academia. Publication records and obtained grants increasingly influence hiring, promotion, and tenure decisions, which forces researchers to deliver publishable results at all costs (van Dalen & Henkens, 2012). However, such publication pressure takes away time from researchers to translate research findings for the public or policy makers and teach; thus, researchers often experience constant tensions due to conflicting role expectations (Fox, 1992).

These pressures and role conflicts can be detrimental to academics' health; often, researchers struggle with stress and an adequate balance between work and non-work obligations (Bunds, 2021). Recent changes in the organization of academic research, such as increased workloads and high levels of job insecurity among early career researchers, might

further contribute to mental health problems. A recent study on Flemish doctoral students reports that 32% are "at risk of having or developing a common psychiatric disorder, especially depression" (Levecque et al., 2017, p. 868). From the doctoral students' perspectives, organizational issues such as job demands, the experienced degree of job control, the team's decision-making culture, and the supervisor's leadership style are often associated with mental health problems (Levecque et al., 2017).

In addition to the pressures that all academics experience and that can give rise to mental health concerns, mathematicians are confronted with cultural images of themselves that depict mental illness even as a superpower that is construed as a competitive advantage in creative work (Moreau et al., 2010; Vejdemo-Johansson et al., 2019). Such a glorification is problematic and creates a culture in which intense work – often done in isolation in the case of mathematicians (Dubois et al., 2013) – is valorized at the expense of one's well-being. The often praised and glorified culture of overwork within academia (cf. Jaremka et al., 2020) resembles the *culture of risk* in elite sports since it encourages extremely long working hours with potentially negative health consequences such as burnout, depression, and anxiety (Bunds, 2021; Jaremka et al., 2020; Levecque et al., 2017).

3.3 Biography, Life Story, and Narrative in the Context of Talent Development

The respective life worlds of elite athletes, musicians, and mathematicians all offer a shared room for interpretations of personal experiences and build the basis for understanding (Luckmann & Schütz, 1975; Muckel & Grubitzsch, 1993). Herewith, the respective life worlds with their structural constraints, opportunities, and pressures play a major role in talent development. The life worlds impact how individuals think, feel, and behave; therefore, they inevitably shape the individuals' constructions of their reality, identities, and lives (cf. Aarresola et al., 2017; McGannon & Smith, 2015).

Individuals, however, enter the respective achievement context with their own history that also shapes which opportunities, constraints, and pressures within the respective life world they perceive and which of their subjectively perceived possibilities are realized (Muckel & Grubitzsch, 1993). From a social constructivist perspective, the person interprets every input from the outside (such as interventions by a mentor) according to his or her own biographically shaped logic. This logic has an impact on whether an input is perceived and processed as meaningful for the individual's development. However, these interpretative meaning-making processes in the form of stories happen within the life world that offers a shared room for interpretation. Therewith, the concept of the life world can be connected to the concept of narrative – within stories, 'the personal' and 'the social' can both be recognized (Haumann, 2012).

3.3.1 The individual biography and the personal life story

On a personal level, a person's individuality is manifested in his or her biography (cf. Schimank, 1988a). The biography represents the subjective reconstruction of the life course (Roberts, 2002). Therewith, an individual's biography is an autopoietic, self-reflective, and transitory process, characterized by self-construction, reconstruction, and constant change (Schimank, 1988a). This means that new experiences are interpreted on the basis of earlier experiences; if experiences are perceived as subjectively meaningful, they will be incorporated into one's biography. Also, new experiences might retrospectively change the meaning of previous experiences within the biography; the past is not fixed but varies depending on present circumstances (cf. Richardson, 1990; Roberts, 2002). Thus, an individual does not simply have a biography; rather, he or she actively constructs his or her own biography throughout his or her life course.

Whereas the biography can be thought of as an internal construct, the life story can be conceptualized as the narrated biography. The communicated life story has to follow rules of

speech and other social conventions (such as time constraints on telling or expectations on the part of the listener). Thus, the life story can never depict the full complexity of the individual's biography (cf. Conzelmann, 2001); rather, it offers a snapshot of a person's life shaped by the current moment and the sociocultural narratives available to the individual within the respective life world. Thus, the biography itself can never be completely captured. Instead, stories are the means by which biographical experiences are given an understandable shape in that they are assembled and made meaningful through a story plot (cf. Roberts, 2002). The plot acts as the organizing theme of the story and might need to be revised when new experiences happen in a person's life (cf. Bujold, 2004) that challenge previous assumptions about oneself and the world. Particularly, critical life events lead a person to question taken-for-granted assumptions about oneself and the world since they disrupt the person-environment-fit (Filipp & Aymanns, 2010). Therewith, critical life events represent marking points in the subjective reconstruction of one's life. The affective consequences and the significance of life events are mediated through individual interpretive processes (Filipp & Aymanns, 2010), which often happen in the form of stories (cf. Schwarzer & Luszczynska, 2012). To make explanatory sense of life events and provide meaning to experiences, a person constructs a story into which life events are integrated coherently and linked causally (Richardson, 1990).

'Bumps in the road', which are often referred to in talent research (Collins & MacNamara, 2012), can be conceptualized as critical life events. The affected individual will process some events as critically (i.e., significant) for talent development and others not – depending on previous experiences, cultural narratives, and the systemic characteristics of the respective achievement domain. The effective adaptation to critical life events of various sorts appears to be crucial for a successful continuation of the developmental pathway (cf. Collins & MacNamara, 2012; Howells & Fletcher, 2015; Sarkar et al., 2015).

Through analyzing life stories, we can assess the perceived impact of critical life events on talent development pathways (cf. Lalanda Nico, 2015; Wippert, 2011). Stories can also offer insights into the trajectories of lives across time; they can reveal the interconnectedness of what might otherwise appear disparate or unrelated factors during the talent development pathway (Carless & Douglas, 2013a). According to Atkinson (1998), "[t]here may be no better way to answer the question of how people get from where they began to where they are now in life than through their life stories" (p. 20). McAdams (1996) even hypothesizes that adults sharing certain common characteristics that make them part of a well-demarcated group (such as eminent scientists or professional athletes) may construct and tell somewhat similar life stories (McAdams & Pals, 2006).

To conclude, individuals construct and communicate meanings through stories (Bruner, 1990; Roberts, 2002) "in order to make sense of life experiences and act within the social and cultural world" (McGannon & Smith, 2015, p. 81). In the words of McAdams (2001), "[o]ur autobiographical stories reflect who we are, and they also reflect the world in which we live" (p. 117). Stories are co-authored by the person him- or herself and the cultural context of the person's life; therewith, stories are always psychosocial constructions (McAdams, 1996). When reflecting on one's own experiences and crafting a personal story about one's life, the storyteller is never completely detached from his or her environment. Even though every life is unique, the stories that individuals within a certain group tell often mirror culturally accepted storylines, so-called cultural master narratives, which circulate within the respective life worlds.

3.3.2 Cultural master narratives

The concept of narrative provides a bridge between personal stories and the dominant discourses within the sociocultural environment. Master narratives are defined as culturally shared stories that guide thoughts, beliefs, values, and behaviors (McLean & Syed, 2015).

They provide storylines of tell-able, acceptable stories, which will be evident within personal life stories. Thus, master narratives impact the themes narrated in individual stories; they influence the storyteller's and listener's perception of the appropriate timing of life events and their sequential order (McLean & Syed, 2015). Master narratives also influence stories at a structural level in that they shape our perception of how stories or various episodes should be constructed (McLean & Syed, 2015). In this regard, the dominant narrative in Western culture is the redemption narrative (McAdams, 2001, 2013; McAdams et al., 2001) – a narrative moving from adversity to triumph. Redemptive stories are supposed to involve adverse circumstances, but the individual, as an active agent of his or her life, is expected to redeem adversities into something positive, experience personal growth, and be lifted to higher levels of functioning because of the experienced adversities. When athletes, for instance, tell life stories that revolve around overcoming adversity to succeed, they follow this redemption narrative and construct an identity based on resilience, determination, and heroism (Papathomas, 2016).

At the individual level, master narratives can help people make sense of their lives to overcome feelings of isolation and alienation (Richardson, 1990). However, master narratives are often impacted by the ruling interests and used to keep the status quo (cf. Richardson, 1990). Thus, master narratives tend to silence the voices of those whose life experiences do not fit the dominant storylines (Frank, 1995). As a response, sometimes alternative narratives develop that are not as powerful as master narratives but that at least provide a template for the stories of those individuals whose life experiences are not reconcilable with the dominant master narratives (McLean & Syed, 2015). Over time, alternative narratives can become master narratives within the respective life worlds, particularly when individuals with high social power tell them repeatedly. Thus, we can observe a socio-historical flux with regard to dominant master narratives (cf. Richardson, 1990).

Research on how culture affects high-achievers' stories about their lives has only been recently conducted in elite sports. Here, the dominant narrative type to story success is the performance narrative (Carless & Douglas, 2013a, 2013b; Douglas & Carless, 2006, 2009). Stories that follow the performance narrative mainly focus on winning, results, and achievement, which are all closely connected to the storyteller's mental well-being and identity. Success is depicted as being achieved through hard work and extraordinary dedication (Kilger, 2017). It is the dominant narrative type in elite sports, supported and most often heard in public. However, it may result in serious problems for athletes whose life experiences no longer align with the dominant narrative. Douglas and Carless (2006) identified two alternative narratives, namely the discovery and the relational narrative, which, however, are not as powerful and widely distributed as the performance narrative. Such analyses suggest that elite athletes and assumingly other high-achieving individuals within other achievement domains might have a limited repertoire of narratives to frame their experiences.

To sum up, stories always have two sides, one personal and the other social. On the one side, stories help us to see people as unique individuals with the agency to shape the worlds they live in. On the other side, cultural master narratives circulating in the respective life worlds shape the stories and lives of those living within these worlds (McGannon & Smith, 2015; Smith & Sparkes, 2009).

3.3.3 The relation between personal life stories and cultural master narratives

Narrative scholars seem to disagree about the relative importance of 'the personal' and 'the social' in the construction of the personal life story (Smith & Sparkes, 2006). One group of scholars places a greater emphasis on the individual's role in constructing the personal life story, still acknowledging that the tools used in this construction are social (e.g., McAdams, 1996). Another group of scholars attaches greater importance to connectedness and social

aspects of narrative in the story's construction, which is illustrated in the following quote by Atkinson et al. (2003):

> People do things with words, and they do things with narratives. They use biographical accounts to perform social actions. Through them they construct their own lives and those of others. (…) Such accounts are certainly not private, and they do not yield accounts of unmediated personal experience. If we collect spoken (and indeed written) accounts of 'events' or 'experiences', then we need to analyse [sic] them in terms of the cultural resources people use to construct them, the kinds of interpersonal or organizational functions they fulfil [sic], and the socially distributed forms that they take. (Atkinson et al., 2003, p. 117)

Sparkes and Smith (2008) differentiate between narrative constructionism and narrative constructivism to denote these two different strands of thought. According to their differentiation, narrative constructivist inquiry places a greater interest on a person's experiences and the person's own engagement in the process of story construction, resting on the assumption that stories can reflect the realities of personal experiences (Sparkes & Smith, 2008). In contrast, within narrative constructionist inquiry, stories represent a form of social action and a sociocultural phenomenon rather than an inner realm of individuals. According to this line of thought, stories do not offer a transparent window into an independent reality but help construct reality itself. Consequently, when analyzing personal accounts of experiences and events, the focus should lie on identifying cultural resources that people employ to construct their stories (Atkinson et al., 2003; Sparkes & Smith, 2008). People may tell personal stories, but from the viewpoint of narrative constructionism, stories are not made up by the people themselves but constructed from the narratives surrounding the storytellers (Smith & Monforte, 2020).

Within the present dissertation, I take a slightly different stance with regard to stories and narratives that diverges from the described differentiation by Sparkes and Smith (2008), which mainly rests on psychologically informed scholarship on social constructivism.

Drawing on the long tradition of sociologically informed scholarship on social constructivism that builds the basis for the theoretical framework within this dissertation, it can be asserted that constructions of phenomena take place at multiple levels (cf. Luckmann & Berger, 1966). Constructions at one level are structurally coupled to constructions at another level but can never fully reflect those (cf. Luhmann, 1984; Maturana, 1982). Applying the ideas of social constructivism to life stories and narratives leads me to the following theoretical assumptions: A personal life story cannot exactly mirror the master narratives that exist in the broader sociocultural context. Instead, the personal life story can be thought of as a subjective reconstruction of the cultural master narratives against the background of the individual's own experiences (cf. Schimank, 1988a). The individual story is structurally coupled to these master narratives, which operate at the societal level, and, therefore, only indirectly impact the construction of the personal life story (cf. Hejl, 1992). Analytically, personal life stories can only provide insights into the storyteller's own logic; however, different personal life stories can still share similar properties such as structures, contents, tell-ability, and consequences (Frank, 1995). Through a comparative analysis of multiple personal stories, it becomes possible to approximate master narratives; however, from a social constructivist perspective, types of narratives built on personal life story accounts are not the master narratives themselves.

4 Preliminary Conclusion

Within this dissertation, I aim to offer a social scientific perspective on talent and its development. As discussed previously, I generally use the term talent (and not giftedness) in this dissertation, acknowledging that the underlying research problem (i.e. the development of high-achievement) is not domain-specific but of interest within a variety of achievement domains such as sports, science, music, and arts. Most current talent development research is still dominated by a positivistic paradigm that tends to fragment and reduce the complexity of developmental processes (cf. Cohen et al., 2004) at the expense of more dynamic and holistic explanations in which 'the personal' and 'the social' both have their place. To elucidate the socially and culturally embedded nature of individual talent development pathways, approaches that can capture complex relationships between individual agency and the social context are needed (cf. Cohen et al., 2004). Thus, I use a social constructivist paradigm that can help illuminate aspects that are obscured by more positivistic approaches.

The person considered talented develops in the life world of the respective achievement domain but already enters this domain with his or her own unique history. Along the developmental pathway, a myriad of factors such as life events and talent-related norms, values, attributions, and narratives that circulate within the respective life worlds impact the high-achieving individual. From a social constructivist perspective, how an individual reacts to such 'inputs' depends on his or her biographical logic; high-achieving individuals are the constructors of their own stories and, eventually, their own (talent) development. However, it is important to keep in mind that personal life stories do not develop within a vacuum but are psychosocial constructions impacted by the sociocultural context.

For successful talent development to occur, the problem arises how to make the individual with his or her own unique history fit to the structural peculiarities of the

achievement context, or how to make the context fit to the person. The research interest within this dissertation focuses on processes of 'fit-making' between person and context along the talent development pathway. A more specific focus lies on the question of how high-achievers within different achievement contexts retrospectively construct their talent development pathways taking into consideration the sociocultural specifics of their respective life worlds. Notably, the dissertation project aims to offer theoretical, methodological, and empirical reflections on these matters to address some of the identified desiderata of talent research and build the basis for future research on talent and its development. For this purpose, the dissertation consists of seven articles that are all informed by social constructivist thought.

4.1 Research Questions on a Theoretical Level

During talent development processes, the individual to whom the label 'talent' is attached has to adapt (or be made fit) to the expectations of the respective achievement context. Hence, we need a theoretical approach that is sensitive to an understanding of talent as historically changing and contextually embedded. In Article 1, we offer a systems theoretical conceptualization of talent that does justice to the asynchronous, dynamic, multidimensional, and systemic nature of talent development. According to our conceptualization, perturbations from the outside environment and their biographically shaped processing on behalf of the individual are constitutive for initiating developmental change during talent development. Therewith, life events also constitute an essential part of development. Consequently, Articles 2 and 3 offer theoretical deliberations on the role of critical life events within complex and multidimensional developmental processes. The research questions for each of the three theoretical research papers are the following:

Article 1

- How is talent currently defined in sports scientific research?
- How can talent be conceptualized from a social scientific perspective that considers its multidimensional, dynamic, and context-specific nature?
- Which methodological and practical implications can be deduced from a systems theoretical conceptualization of talent?

Article 2

- How can the influence of (critical) life events and transitions on complex and multidimensional developmental processes be theoretically conceptualized?
- Which role does retrospective biographical research play when individual and sociocultural factors during development are to be considered?

Article 3

- From a theoretical perspective, which role do critical life events play in talent development pathways?
- What is the current state of research on the impact of critical life events on the biopsychosocial development of high-achievers?

4.2 Research Questions on a Methodological Level

Based on the theoretical deliberations, the next three articles of this dissertation focus on the methodological implications of the formulated theoretical insights. From a systems theoretical perspective, living systems change in self-referential ways; the person considered talented generates behavioral changes according to his or her own logic. Inputs from the environment are re-constructed in their meaning against the background of the system's internal logic. Qualitative research can help gain insight into the logic of a living, human system that constructs meaning in a self-referential manner. Particularly, the narrative study

of lives allows examining the biographically shaped logic of an individual (cf. Roberts, 2002). With a narrative approach, we can gain a more holistic view of talent development (cf. Cohen et al., 2004) since the concept of narrative is sensitive to personal and social phenomena. Thus, Articles 4 to 6 aim to offer methodological reflections on qualitative research and particularly narrative research in the context of talent development.

Articles 4 and 5 focus on study designs that would allow capturing the context-specific nature of developmental processes. As illustrated within the section on the life world of elite athletes, musicians, and mathematicians (see Chapter 3.2), the body plays a constitutive role in development, particularly within the life world of elite athletes. However, the body is often neglected within qualitative research studies; consequently, Article 5 specifically addresses this shortcoming of narrative interviews and suggests alternative methodological approaches that would allow to capture bodily processes.

Within Article 6, we describe the development of the biographical mapping approach – a method that we developed to capture the relation between structural and individual developments. With the biographical mapping approach, we aim to offer a methodological instrument that allows for a deepened reflection on the personal life story through the combination of a narrative interview approach with a semi-structured drawing activity. Biographical mappings allow to assess global developments and interactions of psychosocial dimensions (such as general well-being, psychological distress, perceived performance potential, and pressure) that are not easily recounted within the traditional life story interview but are nevertheless important within talent development pathways. Specifically, the three methodologically oriented articles aim to answer the following research questions:

Article 4

- From a methodological perspective, how can we assess the complex and dynamic interaction of various factors during psychosocial developmental processes?
- Which role can qualitative research play in this regard?

Article 5

- What are the limitations of current narrative interview approaches?
- From a methodological perspective, which distinctive features should be considered in the context of narrative interviews with athletes?
- How can bodily processes be captured within narrative interviews?

Article 6

- From a methodological point of view, how can we handle the limitations of current narrative research (for instance, lack of an overall perspective on biopsychosocial aspects of development)?
- How can we assess biopsychosocial developmental trajectories within a qualitative research paradigm?

4.3 Research Questions on an Empirical Level

Empirically, the integration of an athletic, musical, or mathematical career into everyday life and the individual's biography can only be re-constructed if research focuses holistically on the whole person (cf. Delow, 2000) and not only on those aspects that appear to be relevant to talent-related pursuits. Thus, in Article 7, I examine the life stories of high-achieving individuals within the three different achievement domains of sports, music, and mathematics. In many respects, these domains appear quite disparate. On close inspection, however, different areas of excellent human performance also have commonalities. As illustrated in chapter 3.2, musicians, athletes, and mathematicians all face the challenges of

competition and uncertainty in their careers. Sports, music, and mathematics are also the classical achievement domains most often associated with the term talent in the public discourse. Therewith, they offer an ideal context to investigate how cultural ideas about talent inform the retrospective construction of the talent development process.

Based on the theoretical and methodological deliberations within Articles 1 to 6, Article 7 offers the first exemplary empirical findings. Within this study, we employ the biographical mapping approach described within Article 6 and follow the theoretical reflections on the role of critical life events for developmental processes reflected on in Article 2 and 3. The empirical study also realizes some of the methodological implications of the systems theoretical conceptualization of talent formulated in Article 1. More specifically, Article 7 aims to answer the following research questions:

Article 7

- How do high-achievers story their own development?
- To what extent do we observe structural and thematic similarities in the stories on developmental pathways of high-achievers from three different achievement domains?
- How do high-achievers process critical life events within their stories, how are life events related to each other, and what is their perceived relevance for development?
- How do culturally informed ideas about talent impact the retrospective construction of talent development pathways? To what extent do the life worlds of elite athletes, musicians, and mathematicians share similar views on talent?

5 Collection of Articles

5.1 Tabular List of Articles

5.1.1 Theoretical deliberations (Articles 1-3)

Article 1

Title	Authors	Journal	Topic	Status
Talent as a social construction: Proposing a system theoretical conceptualization of athletic talent	**Jannika M. John,** Ansgar Thiel	*Zeitschrift für Erziehungs-wissenschaft* IF (2020): 0.828	Conceptual and theoretical paper • Critical examination of current conceptualizations of athletic talent • Presentation of a theoretical framework on athletic talent informed by systems theory • Talent as a social construction that is historically changing and contextually embedded • Talent development as a process in which a person is made fit to the talent-related expectations of an organization that acts as the 'purchaser' of talent • At methodological level, call for idiographic, multidisciplinary approaches to explore intrinsic dynamics of talent development pathways • At practical level, call for highly individualized talent development practices	Under review

Contribution to Article 1 by Jannika M. John

- First author
- Conceptualization of the theoretical framework together with Ansgar Thiel
- Reviewing current conceptualizations of athletic talent, particularly dynamic systems oriented conceptualizations
- Co-authoring the original draft of the manuscript with Ansgar Thiel
- Visualization of the theoretical conceptualization of athletic talent
- Revision of the manuscript together with Ansgar Thiel

Article 2

Gropper, H., John, J.M., Sudeck, G., & Thiel, A. (2020). The impact of life events and transitions on physical activity: A scoping review. *PlosOne.* https://doi.org/10.1371/journal.pone.0234794

Title	Authors	Journal	Topic	Status
The impact of life events and transitions on physical activity: A scoping review	Hannes Gropper, **Jannika M. John**, Gorden Sudeck, Ansgar Thiel	PlosOne IF (2020): 3.240	Scoping review • Theoretical deliberations on life events and transitions from a developmental perspective (focus on their processual character and temporality) • Assessing the state of research with regard to the impact of life events and transitions on the complex and multidimensional behavioral phenomenon of physical activity • Advocating for new lines of research using biographical retrospective studies to assess life events and their impact on behavioral pathways from an individualized and sociocultural perspective • Arguing for the potential of biographical analyses to reveal how and why life events become personally significant, how life events are perceived and processed, and how they account for changes in behavioral patterns across the life course, and the underlying meaning attributed to such developments	Published 2020

Contribution to Article 2 by Jannika M. John

- Co-author
- Discussions with Hannes Gropper particularly with regard to the theoretical conceptualization of life events and transitions, the search strategy, inclusion and exclusion criteria, and statistical results of included studies
- Support during the screening process, acting as a critical friend
- Critical feedback throughout the process of writing and revising the manuscript
- Revision of the manuscript before publication together with co-authors

Article 3

John, J. M., Gropper, H., & Thiel, A. (2019). The role of critical life events in the talent development pathways of athletes and musicians: A systematic review. *Psychology of Sport and Exercise,* 45, 1-13. https://doi.org/10.1016/j.psychsport.2019.101565

Title	Authors	Journal	Topic	Status
The role of critical life events in the talent development pathways of athletes and musicians: A systematic review	**Jannika M. John**, Hannes Gropper, Ansgar Thiel	Psychology of Sport and Exercise IF (2020): 4.785	Systematic review • Critical life events as significant developmental components in the development of excellence, underscoring the idiosyncratic nature of developmental trajectories • Systematic synthesis of literature on the role of critical life events in the developmental pathways of elite performers in sports and music • Focus not only on performance-related development but on the impact of critical life events on the biopsychosocial development of expert performers • Results of review can help systematically refine and individualize talent development programs	Published 2019

Contribution to Article 3 by Jannika M. John

- First author
- Conception of the systematic review, supervised by Ansgar Thiel
- Conception of theoretical background, research questions, methodological approach, search strategy, synthesis of study results
- Responsible for the screening process; Hannes Gropper acted as the second researcher during the screening process
- Analysis of study results and assessment of the study quality
- Visualization of the results of included studies
- Writing the original draft of the manuscript
- Revision of the manuscript before submission together with co-authors

5.1.2 Methodological deliberations (Articles 4-6)

Article 4

Bekker, S., Bolling, C., Ahmed, O., Badenhorst, M., Carmichael, J., Fagher, K., Hägglund, M., Jacobsson, J., John, J., Litzy, K., Mann, R., McKay, C., Mumford, S., Tabben, M., Thiel, A., Timpka, T., Thurston, J., Truong, L., Spörri, J., van Nassau, F., Verhagen, E. (2020). Athlete Health Protection: Why qualitative research matters. *Journal of Science and Medicine in Sport,* 23 (10), 898-901. https://doi.org/10.1016/j.jsams.2020.06.020

Title	Authors	Journal	Topic	Status
Athlete health protection: Why qualitative research matters	Sheree Bekkker, Caroline Boling, Osman H. Ahmed, Marelise Badenhorst, Joel Carmichael, Kristina Fagher, Martin Hägglund, Jenny Jacobsson, **Jannika M. John**, Karen Litzy, Robert H. Mann, Carly D. McKay, Stephen Mumford, Montassar Tabben, Ansgar Thiel, Toomas Timpka, Joanna Thurston, Linda K. Truong, Jörg Spörri, Femke van Nassau, Evert ALM Verhagen	Journal of Science and Medicine in Sport IF (2020): 4.319	Editorial • Arguing why qualitative research matters to athlete health protection research (injury and illness prevention and management) • Focus on the complexity of psychosocial phenomena in the field of athlete health protection (such as the lived experience of injury, playing hurt in a 'culture of risk', interaction between athletes, professionals, and the sociocultural context of elite sports) • Qualitative research methods as a way to gain in-depth insights into different contexts, thereby facilitating individualized athlete health protection strategies	Published 2020

Contribution to Article 4 by Jannika M. John

- Contributing co-author
- Member of joint discussions on qualitative research within athlete health research as part of the QRSMed (Qualitative research in sports medicine) interest group
- Contributing with Ansgar Thiel to the section in the editorial on playing hurt in the so-called 'culture of risk' in elite sports
- Revision of manuscript before submission together with co-authors

Article 5

Thiel, A., John, J., & Frahsa, A. (2019). Qualitative interviews in sport and physical activity research – do not forget the body. *European Journal for Sport and Society,* 16, 1-4. https://doi.org/10.1080/16138171.2019.1616423

Title	Authors	Journal	Topic	Status
Qualitative interviews in sport and physical activity research – do not forget the body	Ansgar Thiel, **Jannika John**, Annika Frahsa	European Journal for Sport and Society	Editorial • Narrative interviews as methodological gold standard for researching complex phenomena associated with critical life events, illness experiences, and embodiment • Absence of 'body talk' in spoken and recorded words as a methodological limitation of narrative interviews • Suggesting ways how to record and analyze 'body talk' as a way to achieve more detailed descriptions of the interviewee, the meaning of life events, and identity within a sociocultural context	Published 2019

Contribution to Article 5 by Jannika M. John

- Co-author
- Supporting Ansgar Thiel in writing the first draft of the manuscript
  - Contributing to section on narrative interviews
  - Contributing to section on methodological consequences
  - Contributing to section on potential ways to record body talk during interviews
- Revision of the manuscript before publication together with co-authors

Article 6

Thiel, A., Gropper, H., John, J.M., Keppler, V., & Mayer, J. (2020). bioMAP - Development of a software for the retrospective analysis of biopsychosocial health trajectories in elite sport. http://dx.doi.org/10.15496/publikation-38957

Title	Authors	Journal	Topic	Status
bioMAP - Development of a software for the retrospective analysis of biopsychosocial health trajectories in elite sport	Ansgar Thiel, Hannes Gropper, **Jannika M. John**, Valentin Keppler, Jochen Mayer	Tübinger Online-Bibliotheks-Informations- und Angebot (TOBIAS-lib)	Project Report • Development of a software tool (bioMAP) for assessing and comparing intra- and inter-individual biopsychosocial health trajectories of athletes while taking their lifeworld into account • Description of the project phases for software development and offering a manual for users • bioMAP as a tool for research and practice in the context of highly individualized training and talent development strategies	Published 2020

Contribution to Article 6 by Jannika M. John

- Contributing co-author
- Critical revision of the manuscript, in particular responsible for:
  - Description of bioMAP software
  - Description of the manual for software use
  - Contributing to the conclusion and outlook of the report
- Drafting the English version of the project report
- Submission with TOBIAS-lib

5.1.3 Exemplary Findings (Article 7)

Article 7

Title	Authors	Journal	Topic	Status
All roads lead to Rome? Talent narratives of elite athletes, musicians, and mathematicians	**Jannika M. John**, Ansgar Thiel	Qualitative Research in Sport, Exercise and Health IF (2020): 6.736	Narrative interview study • Structural and thematic narrative analysis of 30 narrative interviews conducted with athletes, musicians, and mathematicians on their developmental pathways • Identification of cultural ideas about talent and giftedness within the life story accounts and their impact on the retrospective construction of the developmental pathway • Development of a typology of talent narratives on developmental pathways across the three achievement contexts • Knowledge of different types of stories on developmental pathways can help tailor individualized talent development strategies	*In revision* *(Major revision)*

Contribution to Article 7 by Jannika M. John

- First author
- Conception of the study, supervised by Ansgar Thiel
- Design of the interview guide
- Data collection (conducting all 30 interviews)
- Transcription of interviews (supported by trained student assistants)
- Narrative analysis of 30 interviews; Ansgar Thiel acted as a critical friend and supported in the refinement of the types of narratives
- Writing the original draft of the manuscript
- Revision of the manuscript together with Ansgar Thiel

5.2 Article 1: "Talent as a social construction: Proposing a system theoretical conceptualization of athletic talent"

John, J.M. & Thiel, A. (under review). Talent as a social construction: Proposing a system theoretical conceptualization of athletic talent. *Zeitschrift für Erziehungswissenschaft*.

Submitted author's original manuscript

Talent as a social construction: Proposing a system theoretical conceptualization of athletic talent

Abstract

Most talent management programs are insufficiently successful in developing potential world-class athletes. Such shortcomings might be attributable to the inadequate conceptualization of the underlying construct *talent*.

We propose a system theoretical understanding of talent. In this regard, we consider talent as a social construction that is not only historically changing but also contextually embedded. As a rule, organizations that act as 'purchasers' of talent (sports organizations, orchestras etc.) have a monopoly on defining what is understood as talent. The purpose of defining talent descriptions is to try to ensure that the person with the highest chance of being successful later on is promoted. However, multidimensionality, asynchronicity, and discontinuity of talent development make the prediction of sporting success extremely difficult. Talent development needs to be much more of an iterative process that is highly individualized and idiosyncratic. To make a person fit to the expectations of an organization requires a high degree of flexibility, reflexivity, and, not least, patience from talent development programs.

Using the example of athletic talent, we show that the principles of systems theory provide a useful terminological, theoretical, and methodological basis for the empirical analysis of the complex process of talent emergence and development. Methodologically, idiographic approaches are needed that explore the intrinsic dynamics of talent development pathways.

Keywords: critical review, sport, system, systems theory, talent, talent development

Talent als soziale Konstruktion: Ein Beitrag zu einer systemtheoretischen Konzeptualisierung sportlichen Talents

Zusammenfassung

Die meisten Talentmanagementprogramme sind bei der Entwicklung potenzieller Weltklassesportler nur unzureichend erfolgreich. Solche Unzulänglichkeiten könnten auf die unzureichende Konzeptualisierung des zugrundeliegenden Konstrukts *Talent* zurückzuführen sein.
Wir schlagen im Folgenden ein systemtheoretisches Verständnis von Talent vor. In diesem Zusammenhang betrachten wir Talent als eine soziale Konstruktion, die nicht nur historisch veränderlich, sondern auch kontextuell eingebettet ist. In der Regel haben Organisationen, die als 'Abnehmer' von Talent auftreten (Sportorganisationen, Orchester etc.), ein Monopol auf die Definition dessen, was als Talent verstanden wird. Der Zweck von Talentbeschreibungen ist es, sicherzustellen, dass die Person mit den höchsten zukünftigen Erfolgschancen gefördert wird. Die Mehrdimensionalität, Ungleichzeitigkeit und Diskontinuität der Talententwicklung machen die Vorhersage von sportlichem Erfolg jedoch extrem schwierig. Talententwicklung muss daher als ein iterativer Prozess verstanden werden, der hochgradig individualisiert und idiosynkratisch ist. Die Anpassung einer Person an die Erwartungen einer Organisation erfordert von Talententwicklungsprogrammen demnach ein hohes Maß an Flexibilität, Reflexivität und nicht zuletzt Geduld.
Am Beispiel des sportlichen Talents zeigen wir, dass die Prinzipien der Systemtheorie eine nützliche terminologische, theoretische und methodische Grundlage für die empirische Analyse des komplexen Prozesses der Talententstehung und -entwicklung bieten. Methodologisch sind idiographische Ansätze notwendig, die die Eigendynamik von Talententwicklungsverläufen erforschen.

Schlüsselwörter: kritischer Review, Sport, System, Systemtheorie, Talent, Talententwicklung

Talent as a social construction: Proposing a system theoretical conceptualization of athletic talent

1 Introduction

Talent management, which encompasses the identification and development of talent, has become a hot topic during the last decades in many fields such as sports, business, music, arts, or academics. In general, this debate has been dominated by the nature-nurture-controversy for over 150 years (Baker et al. 2020). When reviewing the state of research in sport science, these two seemingly incommensurable positions are still predominant, but, as we argue, might hinder the progress of talent research.

Despite the long tradition of talent research in sport, most talent management programs are still insufficiently successful in identifying potential elite athletes early on and developing them into elites over the course of a couple of years. Studies on who becomes an elite performer often reveal that those athletes who are most successful at the international senior level started to specialize in their sports quite late and were usually not identified as 'talented' during their early teens (Güllich and Emrich 2014). The predictive validity of junior performance standards for later success is quite low. Less than 10 % of the now successful elite athletes have shown supreme performances by the age of 11 or 12 that would have indicated their later achievements (Martindale et al. 2005).

These observations lead to two possible conclusions: either talent is overrated, as proponents of the nurture position and deliberate practice would likely argue (Colvin 2010; Ericsson et al. 1993), or the commonly held conceptualization and operationalization of talent is inaccurate (cf. Abbott and Collins 2002). In this article, we follow the later line of thought. We propose that the shortcomings of talent identification and development programs and research might be attributable to an inadequate conceptualization of the underlying construct 'talent'. It seems that the construct 'talent' is rarely clearly defined nor explicitly discussed (cf. Baker et al. 2019). Since the understanding of talent influences research designs, identification practices, and strategies for talent development (Baker et al. 2017), we contend that formulating a clear definition of talent is of highest importance.

1.1 Objectives

The following article will firstly provide an overview on the use of the concept of athletic talent in existing work. Building on a brief review of the definitions and conceptualizations of the term 'talent' discussed in sport science, we propose secondly a conceptualization of athletic talent grounded in systems theory in order to offer a complex, yet comprehensive social scientific perspective on talent. Thirdly, we discuss the consequences of a holistic perspective on talent development in sport for the methodological foundation of future talent-related research and practical interventions.

2 State of Research

2.1 Talent Definitions Within Sport Science

A wide range of definitions and conceptualizations of the term ‘talent’ exist in sport science (for an overview see Table 1). Similar to research in the field of work and business (for an overview see Gallardo-Gallardo et al. 2013), the existing conceptualizations of athletic talent can be categorized as either subject- (talent as an individual) or object-related (talent as ability) approaches, as innate (nature) vs. acquired (nurture) conceptualizations, or as approaches that focus on input (such as abilities and motivation) or on the output of talent (such as excellent performance and success).

Most approaches emphasize at least implicitly the future-oriented nature of talent, meaning that talent mainly hints at a *potential* for future top performance and athletic success. The corresponding approaches differ in that they either understand talent as a ‘holistic labelling’ of a person (xy is a talent) or as a set of specific abilities, which are ascribed a predictive power as to the future peak performance (if xy develops the skills a, b, c, then he/she will be successful). Many of these approaches grasp talent, on the one hand, as something static, invariable, and they are, on the other hand, mostly additive, often quite narrow, and almost always unilateral. However, talent is a very dynamic construct that has many different facets, which, in terms of sport-related performance, are only meaningful in a specific context. To the extent that this context (and thus the performance conditions) changes over time and in relation to environmental conditions, the definition of talent, valid for this context, must also change.

Table 1

Exemplary definitions of talent

Source	Definition of talent
Gabler and Ruoff (1979)	a person at a specific developmental stage [...] who has certain physical and psychological prerequisites and conditions that could with great probability lead to high performance in a particular sport at a later stage (p.167; authors’ own translation)
Harsányi (1992)	“those whose inherited physical, physiological, anthropometrical, motoric and social abilities are at level in a given period of ontogeny […] which ensures […] that at the period of peak performance […] the athlete will most probably reach the international level of athletic performance.” (p. 77)
Williams and Reilly (2000)	“current participants with the potential to become elite players” (p. 658)
Brown (2002)	“a special, natural ability” and “a capacity for achievement or success”
Abbott and Collins (2004)	“individuals with the greatest potential to excel in sport” (p. 395)

Hohmann and Seidel (2004)	a person who, taking into account the training already completed, is capable of performing at an exceptional athletic level in comparison with a reference group with a similar biological age and similar life habits, and for whom it is justifiably assumed, mathematically simulated or subsequently determined that he or she will achieve or has achieved top athletic performance in a following stage of development, taking into account personal (endogenous) performance dispositions and attainable exogenous performance conditions (p. 185; authors' own translation)
Gray and Plucker (2010)	"exceptional natural ability of an individual to perform a sports-related task or activity." (p. 363)
Araújo and Davids (2011)	"Talent is not a possession acquired by an individual, nor a fixed property of a performer, but rather a dynamically varying relationship captured by the constraints imposed by the environment and the resources of a performer." (p. 24)
Güllich (2013)	Talent is a person who is still in the process of developing his or her individual peak performance in sport and who is expected to achieve particularly high performance and success in elite sports in the future. (p. 628; authors' own translation)
Faber et al. (2016)	"players with the highest potential for their sport" (p. 396)
Den Hartigh et al. (2018)	"talent emerges from intra- and interindividual variations in the composition of individual dynamic networks" (p. 11)
Sarmento et al. (2018)	"talent should be considered as a dynamically varying relationship moulded by the constraints imposed by the physical and social environments, the tasks experienced and the personal resources of a player" (p. 908)
Baker et al. (2019)	"We propose a multi-faceted conceptualization of talent as: innate (i.e., originating in biological elements present at birth), multi-dimensional (i.e., consisting of capacities from a range of broad cognitive, physical, and psychological categories), emergenic (i.e., involving interactions among factors that combine multiplicatively), dynamic (i.e., evolving across developmental time due to interactions with environments and random gene expression) and symbiotic (i.e., cultural and social factors will determine the ultimate value of an individual's talent)." (p. 27)

In recent years, conceptualizations of talent have become more multi-faceted and complex. One example is the conceptualization of talent from Baker et al. (2019), another the dynamical systems model of talent development from Den Hartigh and colleagues (Den Hartigh et al. 2018; Den Hartigh et al. 2016), which incorporates the idea that a potential for top-performance has to be dynamically defined. Particularly those approaches that define talent from the perspective of dynamic systems theory help to understand athletic talent as a multi-faceted, emergenic, and dynamic phenomenon, and provide an appropriate terminological, theoretical, and methodological basis for the empirical analysis of the complex process of talent development (Davids and Araújo 2019; Den Hartigh et al. 2016; Phillips et al. 2010).

Dynamic systems approaches in talent-related research in sport science are not new, but have – by now – mainly been adopted by human movement scientists. In these papers, the understanding of the talent concept was basically derived from the interacting perceptual,

affective, and task constraints on the individual's path to expertise (cf. Balague et al. 2013; Phillips et al. 2010). Hence, the focus of the analyses was placed on expert skill acquisition; a process wherein the individual finds functional movement solutions to a motor task that fit to his or her intrinsic dynamics on a cognitive and biological level (cf. Seifert et al. 2018). From this perspective, 'talent' is characterized by the ability to find increasingly advanced movement solutions due to adaptive changes of these intrinsic dynamics (cf. Araújo and Davids 2011; Davids and Araújo 2019). For effective talent development, dynamic systems-oriented researchers and practitioners consequently recommend early sport diversification, variable practice settings with constraints being purposefully manipulated by the coach, and the use of rich and diverse learning environments for general skill transfer (e.g. Seifert et al. 2018).

However, when reading the existing works on the emergence of talent from the perspective of dynamic system theory, it can be noticed that environmental aspects are often either neglected or not discussed in detail, and it remains partly unclear what a dynamic system actually encompasses with regard to the phenomenon of talent development. Some scholars understand the developing athlete him- or herself as a dynamic neurobiological system (e.g. Phillips et al. 2010), some authors characterize the process of development of talent or excellence as a dynamic system (e.g. Seifert et al. 2018), while for others, the evolving functional relationship between a performer and a specific performance environment is the dynamic system that represents talent development (e.g. Balague et al. 2013; Davids and Araújo 2019).

In a recent critical review by Baker et al. (2019), the authors attempt to conceptualize talent more clearly and position the role of the environment more prominently. They criticize previous models of talent research focusing too narrowly on cognitive and biological (or genetic) factors and, particularly, on skill acquisition and movement coordination patterns. Furthermore, studies on talent development that include environmental factors use the term 'environment' mostly in a rather narrow sense, often with a sole focus on the immediate performance and skill learning environment, such as opponents, teammates, and coaches (Phillips et al. 2014; Seifert et al. 2018). Hence, while the direct training environment is explicitly considered, less attention is paid to the non-sport-related living environment of the athlete (family, friends, leisure time, school, etc.). Accordingly, the social context in which talent emergence and development take place is, just like psychosocial aspects of development, only partly taken into account. In the following, we therefore try to develop an alternative definition of talent that considers its multidimensional, dynamic, and context-specific nature.

3 A System Theoretical Model of Talent and Talent Development

3.1 A System Theoretical Understanding of Talent

With our article, we propose a system theoretical understanding of talent. In this regard, we consider *talent as a social construction* that is not only historically changing but also contextually embedded (e.g. Friedman and Rogers 1998). As a rule, organizations that act as 'purchasers' of talent (sports organizations, orchestras etc.) have a monopoly on

defining what is understood as talent, and, in this sense, also shape the practical training of people who are considered gifted (in music academies, Olympic Training Centers etc.). The social construction of talent by sport organizations can be compared to an organizational job description, which primarily serves to absorb uncertainty when recruiting candidates for the job (cf. Luhmann 2000; Thiel and Mayer 2009; Thiel and Meier 2004). Hence, the purpose of organizational talent descriptions is to try to ensure that the person with the highest chance of being successful later on is promoted.

Talent-related organizational expectations in sport (but also in music or science) comprise directly action-related aspects, such as motor skills, cognitive skills, or tactical knowledge, but also aspects that are indirectly relevant to success, such as motivation, volition, resilience, and the ability to deal productively with challenges (Collins and MacNamara 2017; MacNamara et al. 2010; MacNamara et al. 2006). The social construct of talent, however, is volatile and dynamic. It can be assumed that there are aspects that endure in the long term (e.g. motor skills or motivation), but also aspects that are subject to a stronger imperative for change (e.g. understanding of tactical knowledge), depending on changes in the environment of the respective action system.

Generally, talent development can be understood as the development of talent-related skills and abilities in a person. The process of talent development is characterized by ongoing dynamic interactions between directly and indirectly performance-related factors, such as genetics, neurobiology, personality traits (such as perfectionism), psychological skills (such as coping skills and motivation) (e.g. Den Hartigh et al. 2018; Den Hartigh et al. 2016) and environmental factors (such as training facilities, competition systems, coaching, familiar support). An important aspect in this regard is that personality traits, skills, abilities and environment change along the developmental pathway, but they change neither synchronously nor continuously. Rather, developmental multidimensionality, asynchronicity and discontinuity are central characteristics of systemic change. The development of sport-specific skills, for example, does not occur at the same level and not necessarily at the same timescale as the development of psychological skills. For example, athletes do not grow physically at the same rate as they mature psychologically (Davids and Araújo 2019). Also, the development of social skills is not necessarily concurrent with the development of a cognitive understanding of tactical systems. Finally, development at the different levels does not proceed steadily. In other words, cognitive learning effects in adolescent athletes often happen in leaps and bounds, which also applies to biological changes such as physical growth (Scott and Saginak 2016).

In the context of *talent development strategies*, two systems that are *structurally coupled* with each other are at the center of intervention efforts. The first relevant system is the organization that defines the canon of skills and abilities that is considered directly or indirectly relevant for being successful in the specific field. The second relevant system is the person who is in a lifelong development process, and is always more than just the athlete, because he/she has also to deal with expectations from other environmental systems (e.g. family, school, friends etc.) which have nothing to do with the specific area of giftedness, but which can nevertheless affect both current performance and performance development.

Against this background, talent development means making a person fit to the performance expectations of an organization (sport, music or science). In this regard, it has to

be considered that the fit of a person to the expectations of an organization depends not least on how possible deficits in individual performance prerequisites (e.g. in basketball height, speed, stamina) can be compensated for by adaptation strategies on both the organizational and the personal level. However, the organizational perceptions of what is required for high performance are usually slow to change. Consequently, a change in performance requirements or a lack of suitable persons who fit the organization's expectations do not necessarily lead to (immediate) changes in recruitment or promotion strategies. In addition, people who, from the organization's point of view, are in principle worth to be considered for a talent development program, do not necessarily apprehend that they have to adapt to the expectations of the organization (for example when they assume that they are already fully trained) or have enough motivation and commitment to work on themselves.

Hence, making a person fit to a talent description of the organization requires a high degree of flexibility, reflexivity, and, not least, patience from talent development programs. Multidimensionality, asynchronicity, and discontinuity are ultimately the reasons why predicting sporting success in individuals is extremely difficult. Hence, talent development needs to be much more of an iterative process that is highly individualized and idiosyncratic. Thus, even if a person has abilities that are extremely promising for success, this does not mean that this person will also be successful in adulthood if it is not possible to set suitable developmental stimuli and cushion stresses in this person's environment.

However, a closer look at the elite sports system shows that its systemic characteristics leave little room for flexibility. Elite sports can be regarded as a *hyperinclusive* system in which the operational logic follows the code win vs. loss (Schimank 1988). *Hyperinclusion* denotes a condition, in which all resources of an individual are needed to fulfill the demands and expectations of a particular system whereas other social systems lose their significance (cf. Göbel and Schmidt 1998; Thiel et al. 2013). In this sense, the better the athlete gets the more he/she has to invest of the biological, psychological, and social resources at his or her disposal (Bette and Schimank 1995). The consequence of this hyperinclusion is that the higher the investment into elite sports, the higher the biographical risks with which the athlete is confronted in his or her career. Hence, talent development is characterized by 'biographical fixations' at a temporal, factual, and social level (Bette et al. 2002), or in other words, the athletes fall into a *biographical trap* (Bette et al. 2002). At the factual level, training and competition gain increasing importance and require, at the temporal level, increased time investments into training, regeneration, and competition, which, at the social level, leads to a loss of social contacts outside of sports. Ultimately, there is almost no 'exit option' left; athletes have to continue on the athletic pathway even if it comes with great risks such as foregoing further education or the risk of suffering from a career-ending injury (Kühnle 2020).

It can be concluded that, on the road to top performance, athletes must cope with the structural constraints typical of elite sports. The complex and idiosyncratic talent development pathways are often marked by several psychosocial transitions (Stambulova 2016). Examples are, among many others, experiences of locational change for career enhancement (Richardson et al. 2012; Ryba et al. 2015), or depressive episodes (Howells and Fletcher 2015; Lebrun et al. 2018). Successful talent development requires that these transitions are managed in adaptive ways according to the logic of elite sports. Given the fact

that athletes differ regarding their biological and psychological conditions, the process of how the athlete adapts to the social structures of elite sports is unique in each case. Ensuring that this adaptation succeeds is a very difficult undertaking. In this regard, based on our system theoretical understanding of talent, we identify three main interferences for talent development that we discuss in more depth in the following: (1) Organizational talent expectations are constantly changing; (2) the people who come into question as talents are shaped by change processes that go far beyond sports-related areas; (3) environmental systems of athletes bring about perturbations whose effects on the athlete's development are very difficult to predict.

3.2 Interference one: The dynamic *nature* of organizational talent expectations

Within organizational talent descriptions, talent is not the additive sum of individual talent-related components but rather a dynamic assembly of interrelated components, which – in a performance-related context – are understood as potentially relevant to future performance. The relevance of talent-related components for peak performance, however, varies depending on the given contextual conditions, such as competitive strategies and rules of the discipline. Furthermore, the context in which athletes act changes over time.

References to established recruitment strategies of the past provide a certain stability in talent selection. However, the establishment of assumed performance prerequisites may well lead to insufficient attention being paid to changes in competition systems due to technical or tactical factors (Baker et al. 2017). As a consequence, some individuals who do not meet the usual expectations of performance requirements, but who nevertheless perform excellently at the junior level, might be overlooked for development measures. For example, in the National Football League (NFL), it was long assumed that good quarterbacks had to be tall and have a very strong arm, while the features of running or passing outside the pocket, which were considered valuable for college sports, were considered less significant for the NFL (cf. Berri and Simmons 2011). Accordingly, talent scouting measures were strongly focused on appropriate metrics such as height and hand size, but less on speed (Berri and Simmons 2011). The success of quarterbacks like Russell Wilson or Kyler Murray, who were considered unsuitable for the NFL by quite a few talent scouts not least due to their small height, led to a redefinition of the skills and abilities necessary for a good NFL quarterback. With this being said, the attribution of talent to an individual might change in adaptive or maladaptive ways. When an athlete who has not been identified as 'talented' suddenly achieves great athletic success, the attribution of talent to that specific athlete might change adaptively, what usually leads to a changed public understanding of the typical characteristics of a 'talent'. Vice versa, the set of skills thought to be necessary for peak performance might also change when individuals who have 'possessed' this skill set are suddenly no longer successful.

3.3 Interference two: The dynamic *nature* of individual skills

In line with previous works (Den Hartigh et al. 2016; Phillips et al. 2010; Simonton 1999, 2001), we suggest that talent-related skills emerge across the life span. Against this background, athletes can be understood as emergenic systems. In an emergenic system, the

whole, equivalent to the state of the system, is not simply the linear addition of the system's components, but results from dynamic interactions over time, which makes processes of emergence highly idiosyncratic and difficult to predict (Simonton 1999; Thelen 2005).

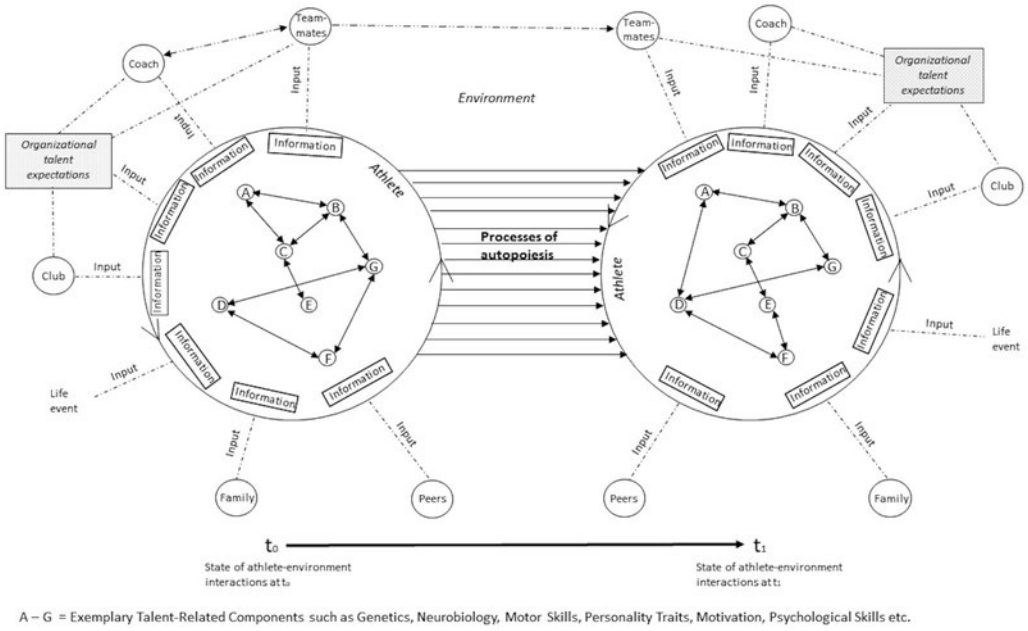
A typical example in elite sport is the growth process of young athletes. On the one hand, physical growth plays a decisive role in the development of talent, because athletic performance usually requires a sport specific combination of body proportions. At the same time, growth processes can hinder athletes' trainability because they happen in a non-linear and dimensionally asynchronous fashion, which – particularly during puberty – can cause deficiencies in coordination and musculoskeletal imbalances (Schubring and Thiel 2014a). On the social level, athletes and coaches do not necessarily realize that a performance stagnation of the athlete can be primarily caused by a developmental asynchronicity in the individual growth process (Thiel et al. 2015). On the contrary, athletes, particularly if they are under much pressure or are very perfectionistic, tend to try to compensate performance stagnation by increasing the training load, which, in consequence, can lead to overloading and specific overuse injuries (Schubring and Thiel 2014b). Thus, with regard to the individual growth process of athletes, it is often not only the physical changes that impact performance but also how athletes cope with the multiple biological changes (which also interact among themselves), and how the athletes' environment shapes the handling of growth.

In this regard, it is important to keep in mind that the 'biopsychosocial homeostasis' of the interplay of success-relevant skills of the athlete in transitional periods is often additionally disturbed by external perturbations.

3.4 Interference three: The impact of external perturbations

From a systems theory perspective, living systems are autopoietic, meaning that they are operationally autonomous, self-referring, and self-constructing (Maturana and Varela 1980; Varela et al. 1974). This has essential implications for talent development. First of all, it means that living systems change in a self-referential way in the regard that each systemic state is dependent on the previous ones, and "every act in every moment is the emergent product of context and history, and no component has causal priority" (Thelen 2005, p. 271). When applying these principles to a person considered talented, it follows that the person generates change of his/her internal bio-psycho-social state by him-/herself. This does not mean that perturbations stemming from the respective social environment (e.g. interventions by the coach, pressure by the training group, or conflicts with the family) cannot precede changes in the behavior of an athlete, but these perturbations do not have a direct cause-and-effect (input-output) relationship. Rather, how the perturbations are processed depends on the current internal structure of the talented person him-/herself, but also his/her history and anticipated future (see Figure 1). Impulses from a system's environment become information within the system, in that they are *re-constructed* in their meaning against the background of the system's internal logic (cf. Luhmann 1990). As long as the demand for adaptation in a system's environment does not make sense in the system itself, it will not change.

Figure 1. A system theoretical perspective on talent development



Work in general psychology (Bonanno 2004; Linley and Joseph 2004; Tedeschi and Calhoun 2004) as well as work within talent-related research in sport science (Howells et al. 2017; John et al. 2019) indicate that critical life events and transitions can be considered perturbations of the biopsychosocial homeostasis of an athlete. As John et al. (2019) suggest with regard to talent development, the significance of a life event, or what transforms a life event into a critical life event, depends on the athlete's internal autopoietic processing of the input. For example, whether an athlete experiences massive self-doubts after a defeat in an important competition or not, likely depends on aspects such as whether it happened for the first time or whether the athlete had already experienced a lot of 'unexpected' defeats in major competitions in the past. Thus, environmental inputs gain their significance for talent development only in relation to the talent's unique history (see in general Thompson 2007), exemplifying the autopoietic and self-referential nature of the talent system.

Transitions in the career of an athlete are also external perturbations. After locational transitions (e.g. the selection for a top-team and the associated change to an Olympic training center), elite athletes often experience initial declines in performance or even minor injuries partly due to the associated changes in training loads (Richardson et al. 2012). For coping with transitional challenges, psychological qualities such as perseverance, the willingness to leave one's comfort zone, goal setting, or self-belief (MacNamara et al. 2010) play a key role.

The athlete is usually capable of coping with small external disturbances by independently readjusting his or her own behavior. However, if perturbations are concentrated in time or cause too much irritation for the system to accommodate, increased variability (for example in terms of performance) can be observed (cf. Vallacher and Nowak 2005), which potentially requires a major change in thinking and behavior so that the system

might move into a qualitatively different and more stable state again (cf. Barton 1994; Granic 2005).

In elite sport, the coach is usually responsible for initiating such behavioral changes. However, the willingness to change as a result of an intervention depends on whether such an adaptation makes sense for the athlete. In a foregoing study, for example, Schubring and Thiel (2014b) analyzed how young elite athletes typically cope with disturbances in their own performance development. The results show that the athletes' try to (a) make sense of the critical events by rationalizing them, (b) regain control over their bodies, and (c) safeguard the continuation of their athletic life-project (Schubring and Thiel 2014b). Thus, athletes make sense of external disturbances against the background of their own logic of thinking.

A typical example for such disturbances in the process of talent development are changes in the reference group (e.g. entry into a top team). The entry into a top team automatically increases the number of competitors on the same performance level. If the performance development of gifted athletes stagnates after such a transition, for example, because their physical development (height, weight) progresses more slowly than that of their peers, the transition can turn into a crisis, even if coaches tell the athletes to be patient. In this regard, cultural narratives, as socially shared ideas about normative and non-normative developmental trajectories (Schubring and Thiel 2014a; Wylleman et al. 2015), are used by athletes as a guide for evaluating their own development.

In the study of Schubring and Thiel (2014b), one athlete developed a growth-related overuse syndrome after the transition to a higher performance level. The pains were conceptualized by the athlete as the result of a misconduct in the sense of not having trained well enough. Such interpretation patterns set in motion a vicious circle that is difficult to break. In case of the injured athlete, the subjectively logic coping strategy was to further increase the training load in order to close the gap with the others. Furthermore, the athlete challenged himself to be more self-disciplined and 'punished' himself with rigorous stretching programs (Schubring and Thiel 2014b). This practice subsequently led to an exacerbation of symptoms what was automatically perceived by the athlete as confirmation of his misbehavior and led to further reinforcement of what actually already had been an unhealthy coping strategy.

This case study shows that successful talent development is to a significant extent dependent on 'managing heterostasis' in order to enable a successful continuation of the talent development pathway (cf. Abbott et al. 2005; Abbott and Collins 2004). From the perspective of systems theory, perturbations can initiate a process of self-reflection, and, if necessary, change. Generally, we argue that athletes – in order to change performance-limiting behavior – do not necessarily have to be forced into unstable states to trigger transitions – as Phillips et al. (2010) suggest. Instead, naturally occurring critical life events (cf. Filipp 1995), both inside (e.g. new coach, contact with a role model, being deselected from a team) and outside of the performance domain (e.g. illness of a family member, start of a romantic relationship, losing a loved one), can generate irritations of the internal homeostasis of the talent and lead to self-reflective processes, which subsequently may initiate transitions to new modes of behavior.

4 Implications for Talent Research and Practice

4.1 Methodological Consequences and Avenues for Future Research

When looking at talent development from the perspective of systems theory, idiographic, multidisciplinary approaches are recommended for research on talent development. In this regard, particular attention should be paid to temporal aspects of the developmental process such as intra-individual variability, trajectories over developmental time, and the underlying mechanisms of change, with temporal variability representing key information (Lichtwarck-Aschoff et al. 2008; Vallacher et al. 2002). One could even go as far as arguing that research should not focus its attention on finding explanations in the sense of detecting cause-effect relationships, but should rather set the focus on identifying dynamic biopsychosocial patterns over time, such as typical vulnerable transitions, or health- and performance-related behavioral vicious cycles.

Methodologically, research on talent development, in the sense of making a person fit to organizational expectations, requires idiographic, un-averaged, and frequent measurements that allow to examine individual trajectories of development rather than group averages (cf. Hayes et al. 2007). Thus, the application of single-subject, time-series approaches to assessment may be warranted (Heiby 1995). These methodological approaches would allow to identify time points in a longitudinal data set when disproportionate changes in parametric values occur. However, such approaches, if applied to phenomena such as the emergence and development of performance-related skills and abilities, might have to encompass time spans of up to 20 years or more. Time limits and financial constraints often make it nearly impossible to gather real-time, time-series data, especially since researchers interested in the emergence of talent over developmental time would need to follow a large number of ‘potential’ elite athletes from childhood to adulthood. However, given the technological advances to monitor athletes on a regular basis, this should be a core strategy in future talent research.

In line with a social constructivist perspective, we argue that another potentially relevant line of inquiry might be the reconstructive interpretation of an athlete’s biography verbalized in the form of a life story. Because life events form the building blocks of life stories (cf. Filipp and Aymanns 2010; Reimer and Matthes 2006), the analysis of life stories is particularly suited to examine how external perturbations are perceived and processed in a self-referential manner. Analyzing individual ‘stories’ of athletes about their athletic career could help to understand the intrinsic dynamics of talent development pathways. Life stories offer insights into the trajectories of lives across time. Storytellers connect events, transitions critical developmental milestones as well as strategies of coping with such experiences in a subjectively meaningful manner in their life stories; thus, a seemingly chaotic sequence of events is given a subjectively meaningful golden thread. In this sense, the analysis of life stories can reveal the interconnectedness of what might otherwise appear disparate or unrelated factors (Carless and Douglas 2013) – from the perspective of those that actually experience(d) the pathway. In this regard, longitudinal and non-longitudinal narrative interviews with current athletes and drop-outs offer the possibility to learn more about the opportunities and pressures of athletic careers.

4.2 Practical Implications

For practitioners within the field of talent development, it is essential to keep in mind that people's development is not only inter-individually different, but also intra-individually multidimensional, asynchronous, and discontinuous. Physical growth does not necessarily happen at the same speed as intellectual growth; psychological maturity does not necessarily evolve at the same time as social maturity. Such asynchronous developments can lead to problems, for example, when coaches who are unaware of these asynchronicities expect athletes to behave maturely only because they are physically mature.

In the talent-related monitoring of athletes, it is therefore important to look not only at the directly performance-related aspects, but also at motivational and affective states, the involvement of athletes in social networks, life events, and the interaction of these factors. In this regard, talent development strategies have to focus on the performer as an individual rather than using generic strategies that might not fit to every athlete's inner and outer environment. Without an understanding of the meaning-making process on behalf of the athlete, the coach will not be able to offer the conditions necessary for the very specific athlete to succeed, not least because the athlete's logic of behavior is neglected.

Given that the subjective relevance of life events and transitions with regard to one's own development depends on the way the athlete gives meaning to these events, particular attention should be paid to how the athlete 'narrates' the respective life event. Guiding self-reflection can only work if there is a key to the athlete's thinking. Hence, it is important that coaches initiate conversations with athletes in which the need for behavior change is articulated in a way that connects to the athletes' thinking logic. If it is possible to convince the athlete of the necessity of a change in behavior (for example, by making it comprehensibly clear that a break will lead to a significant improvement in performance), the likelihood increases that self-reflective processes resulting in adaptive behavioral changes happen. However, the occurrence of life events can neither be controlled by the athlete nor his or her supporting actors. Thus, it appears crucial to prepare athletes to cope appropriately if such events happen. In this context, athletes can be taught adequate coping strategies, such as problem- and emotion-focused coping strategies and reflective activity (John et al. 2019; Nicholls and Polman 2007), and guided to subsequently employ them during and after a life event-related experience.

However, in practice, limited time resources on part of the coach often collide with the complexity of an idiographic approach to talent development so that coaches are also dependent on generalizations in parts of their work. Research on typical vulnerable transitions and coping patterns could at least provide knowledge for coaches on possible developments, and thereby provide a framework for individualized coaching practices. Generally, athletes are particularly vulnerable in transition phases. Coaches should therefore monitor performance stagnations after such transitions very carefully and also pay attention to how athletes cope with such stagnations. Increasing training volumes, adding new members into a training group, or switching to a higher competition level should only be done during stable developmental periods (when no critical transitions for example in the

educational or vocational domain or in the living conditions happen) so that the probability of maladaptation (with the effect of lowering psychological well-being or performance) is reduced.

Furthermore, coaches must not assume that their inputs (such as introduction of new techniques, change in training strategies) eventually create intended effects. From the perspective of system theory, environmental inputs gain their meaning in a self-referential manner based on the internal logic of the person who is considered talented. Talent development is therefore highly dependent on communication skills (cf. Borggrefe et al. 2006), particularly questioning techniques, the ability to listen, and so-called mirroring techniques.

From the view of systems theory, organizations that are responsible for talent development have to consider the dynamic nature of elite sport. They must be prepared to question their decision-making premises in the promotion of talented individuals when changes occur in the organization's environment (in the internal elite sport environment, for example, changes in the rules and regulations or in competition systems; in the external environment, for example, when there are not enough people who fulfill the given ability expectations).

Talent-related organizational decision-making premises in sport, however, are often the result of power processes. This can be observed, for example, when very successful coaches describe certain performance requirements as indispensable for athletic success, although these experiences are actually only representative of those individuals who have actually developed into successful athletes under the coach's supervision. Behind this lies the problem that the attribution of talent to a young athlete is mostly dependent on the subjective assessments of coaches who have gained their knowledge on the basis of their own previous experiences and constructions of reality (Lath et al. 2021). However, it is by no means certain that coaches, even if they are very experienced, can really assess every individual athlete's prospects of success well on the basis of their own previous experiences. In terms of talent development, coaches must therefore be open to the fact that their assumptions can also be wrong, and regularly question their own assumptions.

5 Conclusion

In this paper, we have proposed a system theoretical conceptualization of athletic talent. While working on our ideas, we were inspired by (mainly natural scientific) work in the field of sport science based on dynamic systems theory. However, since previous work has employed a quite narrow neurobiological focus on the emerging talent system, and authors have barely engaged in a focused examination of the ‘system’ concept, system-inherent aspects like self-referential and autopoietic properties have been overlooked in the debate on talent so far. We therefore included concepts of sociological systems theory in our theoretical framework. At the heart of our conceptualization of talent is the attention to the intrinsic dynamics of the social construction of talent and the individual skills. Thereby, we offer a system theoretical conceptualization of athletic talent and its development that can build the basis for more context specific work on talent and its development within sports and beyond.

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5.3 Article 2: "The impact of life events and transitions on physical activity: A scoping review"

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RESEARCH ARTICLE

The impact of life events and transitions on physical activity: A scoping review

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Abstract

Background

Physical activity (PA) is a fluctuating behavior and prone to change across the life course. Changes in PA may be particularly due to the experience of life events and transitions. For well-timed and successful PA interventions, it is important to understand when and why individuals take up or terminate PA.

Objectives

This scoping review aims to examine the extent, range, and nature of research on the impact of life events and transitions on PA and to summarize key findings.

Methods

A systematic literature search was conducted in PubMed, PsycINFO, PsycARTICLES, SPORTDiscus, and Web of Science. Articles were included if they had been published in peer-reviewed journals between 1998 and 2020 and assessed the impact of at least one life event or transition on PA.

Results

107 studies that assessed 72 distinct life events and transitions were included and summarized in ten categories. Events and transitions that are primarily associated with decreases in PA were starting cohabitation, getting married, pregnancy, evolving parenthood, and the transitions from kindergarten to primary school, from primary to secondary school, and from high school to college or into the labor market. Retirement was associated with increases in PA; yet, long-term trajectories across retirement indicated a subsequent drop in activity levels. Divorce was associated with no changes in PA. No trends could be identified for changing work conditions, quitting or losing a job, starting a new relationship, widowhood, moving, and diagnosis of illness.

Conclusion

Life events and transitions can be conceptualized as natural interventions that occur across the life course and that are oftentimes associated with changes in PA behavior. Our study

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indicates that, despite some emerging trends, similar events do not necessarily have similar impacts on PA across individuals. It also shows that the research landscape is characterized by a lack of conceptual clarity and by disparate methodologies, making it difficult to synthesize results across studies.

Introduction

Time and again, research has shown that regular physical activity (PA) is associated with physical [1, 2], as well as mental and social [3, 4] health benefits. Thus, PA is considered "a 'best buy' for public health" [5]. However, PA is a highly complex and multidimensional behavioral phenomenon [6], which is prone to change across the life course [7]. Despite being a significant promoter of health and well-being, regular PA tends to decrease over the life course [8]. Total PA appears to decline particularly during adolescence and the transition to young adulthood [9]. Additionally, Shaw et al. [10] found "steady declines in leisure-time physical activity, beginning in midlife and growing steeper at progressively older ages" (p.763). Contrary to these findings, some longitudinal studies have also identified groups that remain at a given activity level or even increase their amount of PA [11–13].

These results suggest that PA is a *fluctuating* behavior that is not stable over time [14], marked by lapses and relapses [15], and shows a more pronounced trend towards declining than towards stable or increasing levels. This is in line with research arguing that PA patterns track at rather low to moderate levels across the life course [16, 17]. Considering both long-term and short-term health benefits of regular PA [5], it is crucial to understand when and why people take up or terminate PA. Discontinuity, and associated behavioral lapses and relapses, might be triggered particularly by the experience of life events and transitions that occur across the life course. Telama [17] summarizes that "because many transitions and life-changing events experienced during the course of life influence physical activity, the level of tracking of physical activity is likely to vary at different phases of life" (p. 187).

Previously, two reviews have *explicitly* focused on the impact of various life-change events on PA. Allender et al. [18] identified five general life changes that primarily account for drop out from PA, namely, changes in employment status, residence, physical status, relationships, and family structure. In addition, Engberg et al. [19] found evidence that major life events (e.g. the transition to university, beginning to work, cohabitation and marriage, pregnancy and childbirth, divorce, widowhood, and retirement) may have both positive and negative effects on PA, depending among others on age and gender. Recently, an umbrella review on the behavioral determinants of PA across the life course has shown negative associations between PA and the transition to university or emerging parenthood [20], while another review has argued that major life events, life transitions, and the experience of trauma can trigger stress, which in turn impairs efforts to be physically active [21]. In addition, several reviews have focused on particular life events and transitions. These previous reviews have suggested that the transition from primary to secondary school is associated with decreasing levels of total PA [22]. Moreover, leaving high school [23] and evolving parenthood [24–26] are linked to declines in PA, while retirement is linked to increases especially in leisure-time PA and exercise [27].

These reviews have contributed to the understanding of the impact of life events on PA and have shown that research on this topic is characterized by fragmentation and great heterogeneity of study designs and methods. Despite these achievements, we see three shortcomings in

the recent review activity urging for a more comprehensive and up-to-date approach: First, the last review dealing *explicitly* with the question as to how various life events and PA relate to each other has been conducted in January 2011 [19] leaving the last nine years of research unmapped. Second, both Allender et al. [18] and Engberg et al. [19] searched only one (PubMed) and two databases (PubMed/MEDLINE and PsycINFO), respectively. Third, a theoretical underpinning of the search strategies and conceptual clarity in terminology is often missing.

Our aim is to examine the extent, range, and nature of previous research activity on the impact of life events and transitions on PA, to compile key findings, to identify research gaps, and, therefore, to provide an extension to the previous reviews [28, 29]. In particular, we aim to address the following research question that guided our process: How do life events and transitions impact PA behavior across the life course? We chose a scoping approach (i) to map the landscape of previous research activity in a field that is quite heterogeneous and fragmented and (ii) to systematically summarize key findings.

Methods

In order to increase methodological rigor, the procedure of this scoping review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist [30]. Due to a lack of conceptual and terminological clarity, in the following section we first explicate some theoretical considerations that have built the basis for our search strategy before we describe our methodological procedure in more detail.

Theoretical and terminological considerations

We conceptualize life events from a developmental perspective arguing that they can be construed as *natural interventions* that occur across the life course and that may account for ontogenetic change, growth, and development [31]. According to the working definition put forward by Luhmann et al. [32], life events "mark the beginning or the end of a specific status. A status is a nominal variable with at least two levels" (p. 4). For example, marital status (i.e. single, married, divorced, or widowed) might change due to the life events of meeting a partner, marriage, divorce, or the death of a spouse.

Life events are thus singular occurrences that lead to a shift from one status to another. In this regard, they may *trigger* periods of biological, psychological, and/or social adaptation and readjustment and lead to behavioral changes. In the following, we term such adjustment periods *transitions* as they incorporate the processual character and temporality of life events and describe their anticipation (depending on the foreseeability of an event), history, and aftermath [33]. Both life events and transitions are interconnected and therefore two sides of the same experience, yet different in their temporal nature. Minor every-day events (e.g. daily hassles), slow transitions without clearly identifiable life events (e.g. aging, puberty), and non-events (e.g. *not* having a child) are excluded from our conceptualization of the terms life event and transition.

Life events and transitions may mark turning points in (habitual) behavioral patterns [31], such as PA. For our review, we employ a broad concept of PA defining it as any bodily movement produced by skeletal muscle resulting in energy expenditure [34]. PA therefore occurs across various domains and contexts such as leisure-time PA (including sport participation and exercise), occupational PA, active commuting, daily activities, or domestic activities and at different intensities such as light, moderate, vigorous, or moderate-to-vigorous. Table 1 summarizes the key concepts that underpin our review.

Table 1. Theoretical concepts.

Concept	Definition
Life event	In reference to the MeSH term definition for life-change events, yet with some adjustment, life events are conceptualized as singular occurrences (including biological, psychological, social, and environmental), which mark a change in status and therefore require (re)adjustment and effect a change in an individual's pattern of living [31, 32, 35].
Transition	Transitions are conceptualized as status passages that temporally exceed the duration of life events. The duration of a transition varies as a function of the degree of (re)adjustment, which is necessary to adapt to a new status. Generally, life events, which imply a change in status, may trigger a transition or occur within the transitioning process itself (depending on an event's foreseeability) [36, 37].
Physical activity	Physical activity is generally defined as any bodily movement produced by skeletal muscles resulting in energy expenditure [34] and may occur across various domains and contexts and at different intensities.

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Literature search

A broad, yet systematic, search strategy was developed to search the following databases: PubMed (including MEDLINE), PsycINFO, PsycARTICLES, SPORTDiscus, and Web of Science. Search terms were derived from our theoretical and terminological considerations and in accordance with the terms employed in previous reviews [18, 19]. Table 2 displays the search strategy, with #3 yielding the initial results from which studies where then selected. No limits were used.

The databases were searched on August 17, 2018. The search was updated on January, 27 2020. The updated information was combined with the results from the initial search. Results were exported into EndNote Citation Manager and duplicates were removed. Then, two researchers independently screened titles and abstracts for eligibility. Disagreements were resolved through a process of critical debate. If consensus could not be reached, a third researcher was consulted. Full-texts were assessed by a single researcher, who also extracted data from the articles. When in doubt, the inclusion of full-texts was discussed with a second researcher until consensus was reached. Moreover, included full-texts were used for cross-referencing.

Inclusion and exclusion criteria

Papers were included if they (i) focused on life events and/or transitions in accordance with our theoretical conceptualizations; (ii) reported data on PA, which was assessed either objectively (e.g. via accelerometer or pedometer) or through self-report (e.g. via questionnaires or interviews); (iii) were either of prospective longitudinal or retrospective design in order to compare PA behavior before and after a life event or transition; (iv) assessed healthy populations, except for when transitions into disease were analyzed; (v) were published in English or German; (vi) were published in peer-reviewed journals between 1998 and 2020; and (vii) were available as full-texts.

Table 2. Search terms for the literature research.

Set	Search Terms
#1	"life event" OR "life events" OR "life change event" OR "life change events" OR "life-change event" OR "life-change events" OR "life changing event" OR "life changing events" OR "life-changing event" OR "life-changing events" OR "life experience" OR "life experiences" OR "life change" OR "life changes" OR "life-change" OR "life-changes" OR transition*
#2	"physical activity" OR exercis* OR "sport" OR "sports"
#3	#1 AND #2

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Papers were excluded if they (i) were non-empirical (e.g. other reviews, editorials, comments, essays, abstracts, conference submissions, etc.), dissertations, or intervention studies (including randomized controlled trials); (ii) focused only on physical education or sedentary behavior; (iii) did not examine changes in PA behavior itself but rather in psychological or social variables associated with PA (e.g. motivational, intentional, or habitual variables); (iv) used PA as a moderator or mediator for another dependent variable (e.g. weight gain); or (v) dealt with daily hassles, non-events, or slow transitions. The study selection was an iterative process and criteria for inclusion and exclusion were further refined and adapted as knowledge on the topic grew, which is in line with the notion of a scoping review [28, 38].

Data extraction and synthesis

Extracted data included the country in which the study was conducted, the life events and transitions covered, study design, sample characteristics, the employed PA assessment tools, and the PA domains and intensities that were examined (see S1 Table). If papers addressed several research questions, we focused on the data relevant to our research question. Moreover, if statistical models were adjusted (e.g. for sex, age, education, income, previous behavior, etc.), we report the results from these adjusted analyses assuming that this is a more *conservative*, and therefore, a more cautious approach of interpreting results. As our primary objective was to map the research landscape, we do not report on single mediation and interaction effects. As a first synthesis step, we provide a summary of the research landscape in which we also cluster the reported life events and transitions into distinct thematic categories. In a second step, the identified categories are used as a basis for a narrative synthesis of the key findings of the included studies (for both females and males if not otherwise specified). In order to stay true to the scoping nature of the present review and to delineate general trends, we refrained from summarizing results at the level of PA domains and intensities. Additionally, to be included in the narrative summary, results for events and transitions had to be reported in at least two studies. For the synthesis of the more general trends, results had to be presented in at least four studies.

Results

The initial search yielded 22,869 articles with 15,935 remaining after duplicates were removed. After screening titles, abstracts, and full texts, 92 studies were included. Additionally, 15 records were identified through cross-referencing resulting in a total of 107 articles (Fig 1).

The included studies covered a total of 72 distinct life events and transitions, which we grouped into 10 thematic categories. For the life event *major personal achievement* [40], a clear allocation was not possible, since this event was considered to be rather broad and might occur within various categorical domains. Forty-nine life events or transitions (68%) were covered in only one or two studies. Table 3 summarizes, which life event categories, and which events and transitions in particular, were assessed across studies.

Descriptive analyses of the publication landscape over the past twenty-two years revealed an increasing research interest in the impact of life events and transitions on PA with 74 studies being published in the nine years since the last review on this topic has been conducted [19]. More than half of the studies were conducted in the USA (n = 35; 32.7%), Canada (n = 13; 12.1%), and Australia (n = 12; 11.2%). Studies varied with regard to their design, with the vast majority being prospective longitudinal studies (n = 88; 82.2%), followed by retrospective assessments (n = 19; 17.8%). Follow-up time for the prospective longitudinal studies ranged from three months [146] to 25 years [83]. Sample sizes varied from n = 7 [98] to n = 81,925 [123]. The age of participants ranged from three [44] to 91 years [109, 132]. Detailed study

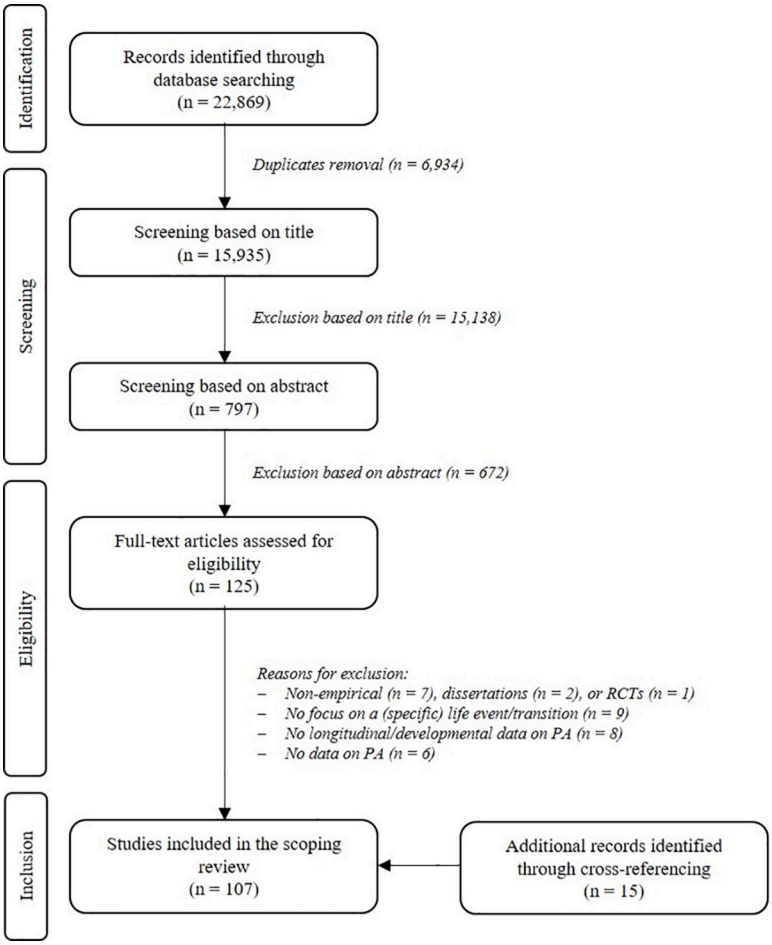

Fig 1. Flow chart of the systematic literature search. (adapted from the PRISMA flow diagram [39]).

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characteristics are summarized in S1 Table. Studies using the same samples are summarized in S2 Table.

A great variety of PA assessment tools was used. Ninety studies (84.1%) employed questionnaires to determine changes in PA. In total, 31 distinct PA questionnaires were used across studies with the Godin Leisure-Time Exercise Questionnaire (n = 6) and the Active Australia Survey (n = 4; three of which used the same sample) being the most recurring tools. Thirty-four studies (31.8%) did not report, which questionnaires were employed. One study combined the questionnaire assessment with interviews. Twenty-three studies (21.5%) used accelerometers or pedometers to assess PA. Of these, seven studies combined questionnaires and accelerometers, eleven studies used only accelerometers (for four to ten consecutive days), and five studies used pedometers usually in combination with either an accelerometer or a questionnaire. As a result, changes in PA behavior were assessed in different ways either taking into account the amount of PA (e.g. frequency and duration, which was assessed either via accelerometers, an open question, or a Likert scale) or by simply asking whether participants engaged in PA or whether PA behavior has changed over time (e.g. yes/no).

Studies assessed seven more or less distinct PA domains: leisure-time PA (n = 80; 74.8%), occupational PA (n = 16; 15%), total PA (n = 22; 20.6%), walking and daily habitual PA (n = 41; 38.3%), commuting and active transport (n = 20; 18.7%), domestic activities (n = 20;

Table 3. Categories of life events and transitions covered across studies.

Category	Life Event/Transition	n (%)	Study (Citation No.)
Education-related events/transitions (n = 38; 35.5%)	Transition to primary school	5 (4.7%)	[41–45]
	Transition to secondary school	10 (9.3%)	[46–55]
	Transition from middle to high school	2 (1.9%)	[56, 57]
	Transition to post-secondary education/university/college	12 (11.2%)	[58–69]
	Return to study	3 (2.8%)	[40, 70, 71]
	(Post)graduation	8 (7.5%)	[59, 67, 70, 72–76]
	Receiving more education	1 (0.9%)	[77]
Employment-related events/transitions (n = 41; 38.3%)	Entry into labor market	10 (9.3%)	[40, 58, 59, 67, 70–72, 76, 78, 79]
	Changing jobs	6 (5.6%)	[40, 71, 72, 77, 80, 81]
	Quitting/stopping/losing job	7 (6.5%)	[40, 72, 77, 79, 80, 82, 83]
	Retirement	29 (27.1%)	[40, 80, 83–109]
	Increased/decreased income	2 (1.9%)	[40, 77]
	Going on welfare	1 (0.9%)	[72]
	Difficulty finding a job	1 (0.9%)	[40]
Health-related events/transitions (n = 19; 17.8%)	Developing/recovering from a major personal illness (e.g. cancer)/injury	10 (9.3%)	[40, 72, 80, 109–115]
	Developing/recovering from chronic diseases (e.g. overweight, diabetes, etc.)	5 (4.7%)	[77, 80, 115–117]
	Becoming normal weight	1 (0.9%)	[77]
	Menopausal transition	4 (3.7%)	[40, 118–120]
	Onset of menarche	1 (0.9%)	[121]
	Major surgery	2 (1.9%)	[40, 80]
	Involvement in a serious accident	2 (1.9%)	[40, 80]
	Developing/recovering from a depression	2 (1.9%)	[77, 80]
	Becoming (un)happy	1 (0.9%)	[77]
	Developing/recovering from a long-term-disability	2 (1.9%)	[77, 109]
	Developing/recovering from pain	2 (1.9%)	[77, 80]
	Starting/stopping to smoke	1 (0.9%)	[77]
	Starting/stopping to drink alcohol	1 (0.9%)	[77]
	Becoming (un)healthy	1 (0.9%)	[77]
	Becoming a caregiver	1 (0.9%)	[83]
Relationship-related events/transitions (n = 23; 21.5%)	Starting/stopping a relationship	5 (4.7%)	[40, 72, 76, 80, 122]
	Starting cohabitation	6 (5.6%)	[40, 70, 76, 78, 123, 124]
	Getting married	15 (14.0%)	[40, 59, 70–72, 76–78, 83, 109, 123–127]
	Getting divorced/separated	11 (10.3%)	[40, 71, 72, 80, 83, 122, 123, 125–128]
	Losing a spouse/partner/widowhood	9 (8.4%)	[40, 77, 80, 95, 123, 127–130]
	Re-marriage	3 (2.8%)	[127, 128, 130]
	Engagement	1 (0.9%)	[72]
	Infidelity of spouse/partner	1 (0.9%)	[40]
	Major decline in health of a spouse/partner	3 (2.8%)	[40, 114, 131]
	Spouse/partner quitting/stopping/losing job	1 (0.9%)	[40]
	Spouse's/partner's retirement	2 (1.9%)	[40, 132]
	Spouse/partner moving into an institution	1 (0.9%)	[40]

(*Continued*)

Table 3. (Continued)

Category	Life Event/Transition	n (%)	Study (Citation No.)
Family-related events/transitions (n = 28; 26.2%)	Pregnancy/birth of a first/subsequent child	24 (22.4%)	[40, 58, 59, 70–72, 76, 78, 79, 109, 124, 133–145]
	Becoming a single parent	2 (1.9%)	[40, 71]
	Miscarriage	1 (0.9%)	[40]
	Stillbirth	1 (0.9%)	[40]
	Having a child with a disability/serious illness	1 (0.9%)	[40]
	Death of a child	2 (1.9%)	[40, 83]
	Major conflict with teenage/older children	1 (0.9%)	[40]
	Increased hassles with parents	1 (0.9%)	[40]
	Parents getting divorced/separated/re-married	1 (0.9%)	[40]
	Serious conflict between family members	1 (0.9%)	[40]
	Major decline in health of close friends/family	1 (0.9%)	[40]
	Death of friend/family	5 (4.7%)	[40, 72, 80, 83, 109]
	Family member being arrested	1 (0.9%)	[40]
	Getting/losing social support	2 (1.9%)	[77, 115]
	Child/other family member leaving home	1 (0.9%)	[40]
	Birth of a grandchild	1 (0.9%)	[40]
Residence-related events/transitions (n = 10; 9.3%)	Moving	5 (4.7%)	[40, 72, 80, 83, 115]
	Moving to an institution	2 (1.9%)	[40, 146]
	Moving out of parents' house/independence	6 (5.6%)	[40, 59, 67, 70, 72, 78]
	Moving back to parents' house	1 (0.9%)	[70]
	Starting a mortgage	1 (0.9%)	[72]
Leisure-time related events/transitions (n = 1; 0.9%)	Starting/stopping a hobby	1 (0.9%)	[80]
	Starting/stopping to go on holiday trips	1 (0.9%)	[80]
Victimization-related events/transitions (n = 2; 1.9%)	Distressing harassment at work	1 (0.9%)	[40]
	Being pushed/grabbed/shoved/kicked/hit	1 (0.9%)	[40]
	Being forced to take part in an unwanted sexual activity	1 (0.9%)	[40]
	Being robbed	2 (1.9%)	[40, 80]
Criminal activity-related events/transitions (n = 2; 1.9%)	Being arrested/going to jail	1 (0.9%)	[72]
	Legal troubles/involvement in a court case	1 (0.9%)	[40]
Force majeure/material loss (n = 1; 0.9%)	Natural disaster	1 (0.9%)	[40]
	Major loss/damage of personal property	1 (0.9%)	[40]

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18.7%), and school activities (n = 8; 7.5%). While some studies focused on PA domains, others (additionally or instead) assessed PA intensities ranging from light (n = 18; 16.8%) to moderate (n = 39; 36.4%) to vigorous (n = 34; 31.8%) to moderate-to-vigorous PA (n = 29; 27.1%), and several combinations of the four intensity clusters (n = 38; 35.5%). As studies often merged several PA domains and intensities, a wide variety of combinations was apparent (for a detailed overview see S1 Table). In this regard, an in-depth and differentiated analysis of findings across all studies was not possible. Therefore, we abstracted from PA domains and intensities and summarized trends. The following sub-chapters focus on the associations between specific events and transitions and PA. Table 4 depicts, which of the included studies reported increases, decreases, or no changes in PA for a respective event or transition. We only summarized general trends for an event or transition when respective results were reported in at least four studies. As single studies assessed different PA domains and intensities, they might be reported multiple times (i.e. for increases, decreases, or no changes). Fig 2 summarizes trends for events and transitions across the life course.

Table 4. Trends and consistency of key findings across studies for events, when results were reported in ≥ 4 studies.

Life event/transition	Increase	Decrease	No change
Education-related events/ transitions			
Kindergarten to primary school	**1** [42]	**5** [41–45]	**1** [41]
Primary to secondary school	**4** [46–48, 50]	**10** [47, 48, 50–57]	**4** [47–49, 51]
High school to university/ college		**14** [58, 60–69, 73–75]	**2** [59, 65]
Family-related events/ transitions			
Pregnancy, Parenthood[1]	**5** [79, 136, 142, 144, 145]	**20** [40, 59, 70, 71, 76, 78, 109, 124, 133, 134, 136–145]	**5** [124, 135, 139, 142, 144]
Employment-related events/ transitions			
Entry into the labor market	**1** [72]	**7** [40, 58, 71, 72, 76, 78, 81]	**4** [59, 67, 77, 79]
Changing work conditions	**2** [40, 72]	**2** [71, 72]	
Quitting, stopping, losing job	**2** [40, 72]		**2** [79, 83]
Retirement	**25** [40, 84, 86–102, 104–109]	**11** [83–86, 93, 98, 103–107]	**8** [85–87, 92, 95, 96, 98, 103]
Relationship-related events/ transitions			
Starting a new relationship	**2** [40, 72]	**3** [76, 122, 123]	**2** [72, 122]
Starting cohabitation		**3** [70, 76, 78]	**1** [124]
Marriage	**1** [125]	**9** [40, 59, 70–72, 76–78, 109]	**5** [72, 77, 83, 124, 126]
Divorce	**2** [126, 127]	**2** [40, 122]	**5** [71, 83, 122, 125, 128]
Widowhood	**3** [40, 129, 130]		**4** [77, 95, 127, 128]
Health-related events/ transitions			
Diagnosis of illness[2]	**7** [77, 111–114, 117, 118]	**7** [40, 77, 109, 110, 109, 114, 117]	**2** [72, 114]
Residence-related events/ transitions			
Moving	**1** [79]	**1** [109]	**2** [72, 83]

[1]Pregnancy and parenthood were subsumed as one event as several studies assessed PA changes across pregnancy including a postpartum period

[2]Diagnosis of illness also includes the diagnosis of a chronic condition

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Education-related events and transitions

Educational transitions were covered from early childhood (e.g. from kindergarten to school) to young adulthood (e.g. entry into post-secondary education or (post)graduation). Five studies assessed the transition from kindergarten to primary school and found mainly decreases in PA [41–45]. Two of these studies reported a rebound effect to or beyond pre-school levels [42, 44].

Similarly, findings on the transition from primary to secondary and from middle to high school showed mainly declines in PA across this transition [47, 48, 50–57]. Yet, studies also reported increases [46–48, 50] and no changes [47–49, 51] in PA, which was due to the assessment of different PA domains and intensities and whether activities occurred during weekdays or the weekend.

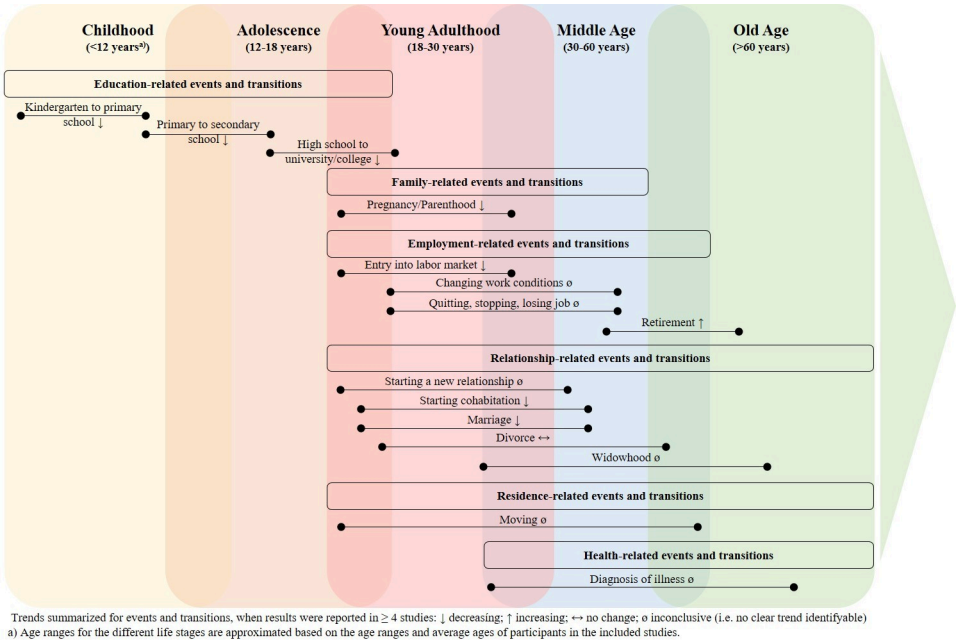

Fig 2. Summary of key findings of the impact of life events and transitions on PA across the life course.

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Studies, which focused on the transition from high school to post-secondary education (e.g. college or university) or leaving full-time education (e.g. started to work), showed that this is a period during which emerging adults are vulnerable to decreasing PA levels [58, 60, 61, 63–65, 67–69, 73, 76]. A greater proportion of high school graduates decreased their PA levels as opposed to those who increased PA [61, 62] and a shift from meeting PA guidelines to not meeting them occurred [75]. Two studies indicated that changes in PA were dependent on the environmental context, as high school graduates who started working were more likely to engage in moderate-to-vigorous and occupational PA than those who transitioned to post-secondary education although, in general, both groups tended to decrease their PA levels [73, 74].

Employment-related events and transitions

Beginning paid work or entry into the labor market was mainly associated with decreases in PA. These declines were particularly pronounced in leisure-time PA [40, 58, 71, 72, 76, 78, 81], although two studies found contrasting findings for women and men [72, 77]. Four studies found no changes in PA [59, 67, 77, 79].

Changes in work conditions or jobs were associated with both decreases [71, 72] and increases [40, 72] in PA depending on domain, intensity, age, and gender. Similarly, losing or quitting a job or having a decreased income were associated with more [40, 72] and less [40] PA, while two studies reported no changes [79, 83]. These results again depended on PA domain, intensity, gender, and age. Being discharged from military was associated with a shift from 68.2% of participants meeting PA guidelines to 50.4% [82].

Retirement was the most examined life transition with 29 studies (27.1%). In general, retirement was associated with increases in leisure-time PA, (recreational) walking, and domestic activities [40, 84, 85, 87, 88, 90, 91, 93, 96, 99, 100, 103, 104, 106–109, 132] and decreases in occupational PA, active transportation, and total PA [83, 84, 93, 103, 104, 106, 107]. With regard to PA intensities, an increase especially in light and moderate PA occurred [87, 96], whereas findings on vigorous and moderate-to-vigorous PA were more ambiguous [93, 95, 96,

105, 132]. Qualitative data suggests that most retirees experience an increase in PA, while only a minority reports decreases or no changes at all [97] Prevalence data similarly indicates that there is an increased probability of meeting US government's PA guidelines after retirement [94]. With regard to the type of retirement, findings were heterogeneous. Transitioning to full-time and voluntary retirement was linked to increased PA levels [89, 90], whereas transitioning to economic inactivity due to disability led to decreases [89, 105]. For the latter, however, one study reported declines in women only, whereas men increased their PA [96]. Retiring from a physically demanding job was associated with a decrease in PA [86], whereas for those retiring from a sedentary job, there was an increase [86]. Similarly, PA declined more in women and men from manual than for those from non-manual social classes [84]. Some studies reported on the long-term trajectories of PA patterns across the retirement transition indicating that PA tends to increase right after retirement but declines later on [91, 99, 102, 104, 105]. In contrast, two studies found evidence that PA levels remained stable after an initial increase [101, 108]. Findings for the pre-retirement period were ambiguous with reported increases and decreases in PA [102, 105] depending on domain and gender.

Health-related events and transitions

Being diagnosed with a serious illness or disease was associated with mixed outcomes. Studies investigating changes in PA behavior after a cancer diagnosis reported both increases and decreases [110–113], while being diagnosed with a chronic disease or condition was linked to increases in PA [77, 117]. However, for older women, the diagnosis of an illness, having surgery, developing pain, and becoming obese or "(un)healthy" were associated with a decrease in PA [40, 77].

Additional health-related events and transitions included the menopausal transition, which was associated with decreases in PA in two studies [118, 119] and with no changes in one study [120], the onset of menarche, which was linked to a significant negative slope in PA (with the gynecological age-based model but not the chronological one) [121], and the onset of impaired sleep, which entailed an increased risk of becoming physically inactive [116]. These findings are in line with qualitative research suggesting that the onset of health and mobility problems is associated with constraints regarding PA [109].

Relationship-related events and transitions

Findings on the impact of starting a new close relationship were mixed with two studies reporting increases in PA for young women [40] and men [72],two indicating decreases for both genders [76, 123], and one reporting decreases only for women [122] Ending a relationship was rather associated with increases in PA [72, 123] depending on domain and gender. Starting cohabitation was linked to decreases in PA [70, 76, 78], although one study found no changes [124]. Becoming engaged and getting married were mainly associated with decreases in PA [40, 59, 70–72, 76–78, 109, 126], depending on domain, intensity, and gender. Only one study found a positive relationship between marriage and PA outcomes [125]. Five studies reported no changes in PA, however, depending on domain, intensity, or gender [72, 77, 83, 124, 126]. Getting divorced or separated yielded mixed results, however, showing a trend towards no changes [71, 83, 122, 125, 128]. In addition, two studies reported decreases in PA in young women [40] and men [122], whereas two other studies indicated increases in PA [126, 127].

The death of a spouse and widowhood were associated with increases in PA in three studies [40, 129, 130] while four studies reported no changes [77, 95, 127, 128]. These relationships were dependent on PA domain, gender, and time since bereavement. Getting re-married and

re-coupling were associated with both decreased [122, 128] and increased [130] levels of PA, again depending on domain and gender.

Family-related events and transitions

Becoming a parent was primarily associated with decreases in PA [109, 124, 136], which were particularly pronounced in women [40, 70, 71, 139] and first-time parents [59, 76, 78, 124, 138, 142]. One study described the quality of change in PA as a smooth decline for women before and after birth, whereas men experienced a rather abrupt drop in the year after birth [140]. Expecting a second or subsequent child was associated with increases in light activities [142], yet, also with decreases in leisure-time PA [124]. Data on group trajectories reflects these tendencies as more women become inactive across the transition to parenthood than those who became active [133, 139]. Nevertheless, one retrospective study indicated that new parents might substitute activity domains, thus, not abandoning PA altogether and that parenthood might also present an opportunity to become more active [136].

Changes in PA were not only associated with parenthood but already with pregnancy as one study reported that substantially more women decreased their PA as opposed to those who increased theirs [137]. In general, pregnancy was linked to declines in PA [134, 141, 143–145]. Some studies, however, indicated increases in light activities such as walking or domestic chores [79, 141, 144, 145]. Results on long-term trajectories from pre-pregnancy to parenthood were ambiguous with some studies reporting rebound effects across the postpartum period [134, 141], one study reporting no changes in PA from pregnancy to postpartum [143], and one study indicating slight increases during maternity leave, which decreased again upon return-to-work [135]. Despite these trends, one study indicated that individual growth trajectories varied significantly from the average growth curve [134].

Residence-related events and transitions

Moving out of the parental home and gaining residential independence was linked to decreases in PA [59, 78] or no changes [67]. Moving in general was associated with no changes [72, 83], but with increases in transport-related walking when moving to a less urbanized area [79]. Moving to an institution, such as retirement living, was similarly associated with significant decreases in PA [40, 146]. Qualitative data suggested that relocations were often perceived as disruptions in social networks, therefore leading to a drop in activities [109].

Discussion

In the present scoping review, we examined the state of research on the impact of life events and transitions on PA behavior across the life course. In this regard, we mapped the research landscape and summarized key findings.

Life events and transitions that were covered by studies spanned from early childhood to old age and were thematically clustered into ten distinct categories. Childhood, adolescence, and young adulthood were life phases that displayed a wide variety of life events and transitions, that were oftentimes education-, relationship-, and family-related. For middle and older aged samples, the life events and transitions that were examined the most were illness, bereavement, and, above all, retirement.

Our results are mostly in line with previous reviews indicating that events and transitions during young adulthood are oftentimes accompanied by declines in PA [18–20, 23–26] and that retirement may offer a *window of opportunity* [105] for positive changes in PA despite declines in occupational PA and active commuting [19, 27]. Moreover, our results indicate a decreasing trend in PA for the transition from primary to secondary school. This corresponds

to one review that reports results for six studies that we have included as well [22]. Additionally, despite including six more studies (including those for the transition from middle to high school), our results similarly indicate that changes in PA across this transition are dependent on PA domain, intensity, and time of the day or the week. Our review shows that for some life events and transitions (e.g. changing work conditions, quitting or losing a job, starting a new relationship, widowhood, moving, or diagnosis of illness), it is not possible to summarize clear trends. This issue has already been emphasized in the review by Engberg et al. [19] indicating that the causal and directional impact of life events and transitions on PA must not be overstated. If and how individuals adapt to the same event is a highly idiosyncratic process that depends on a multitude of factors (including psychosocial moderators and mediators that are oftentimes not assessed) and that might go hand in hand with increases, decreases, or no changes in PA at all. Moreover, life events and transitions might account for substitution effects regarding PA domains and intensities, thus, not rendering total PA.

Limitations of current research and desiderates

Limitations in the current state of research can be summarized as theoretical shortcomings on the one hand and methodological issues on the other. Subsequently, we want to discuss these issues and suggest some potential future directions.

Theoretical limitations. On a theoretical and conceptual level, the majority of included studies neither precisely defined the terms *life event* or *transition* nor did they provide a theoretical framework that conceptually relates life events and PA behavior. The lack of terminological and theoretical framing became particularly apparent in vague terminology. For instance, some studies used the term life event for processes or *slow transitions* (such as difficulties finding a job, "becoming (un)happy", or becoming overweight or obese), which would, according to our definition, not account for a life event as a change in status. Yet, these studies also assessed other events and were, therefore, included in this review. Similarly, some life events were rather unspecific and it was not clear what they entailed (e.g. "major personal achievement", "receiving more education", or "becoming (un)healthy"). Similar to the lack of conceptual clarity regarding life events, studies rarely reflected upon the concept of PA. Most studies acknowledged some sort of basic definition (mostly referring to Caspersen et al., [34]), however, they focused on a variety of different PA domains and intensities often resulting in inconclusive or mixed findings and making it rather difficult to synthesize results in a differentiated, yet concise fashion.

We think that the lack of conceptual clarity with regard to the terms *life event* and *transition* and the complexity of a phenomenon like PA need to be addressed in future research. Theoretical and terminological awareness are highly relevant as they help to guide research processes and embed empirical findings within a framework for interpretation that increases scientific rigor, reduces the risk of jumping to hasty conclusions, and allows for comparability across studies. Theories should therefore be at "the center of research" [147, p. 2] and play a key role in future research.

Methodological limitations. Terminological and conceptual disparities resulted in quite heterogeneous methodological approaches across studies as indicated by the variety of sampling procedures and life event assessment tools that were employed. Most studies chose participants, who found themselves in a period in which a given event or transition usually occurs (e.g. educational transitions or retirement). Others used demographic questionnaires to assess whether a life event (e.g. marriage, school enrollment, or change in employment status) had occurred in a given period. Finally, few studies used retrospective interviews or Life-Event-Scales that stress more on the subjective significance of an event. Independent of the

methodological approach, the studies rarely provided theoretical justifications for the decision on how to assess a particular life event or transition.

Methodological heterogeneity also became evident with regard to the use of PA assessment tools. Thirty-one different PA questionnaires targeting various domains and intensities and using different question formats were applied. Additionally, 34 studies did not specify which scales were used. Objective PA assessment tools (e.g. accelerometers or pedometers) were used in only 21.5% of the studies–mostly with children and adolescents–and were rarely combined with self-reports on PA habits. This fragmented and inconsistent use of assessment tools and validated scales has already been indicated by Engberg et al. [19] and complicated the comparison of results across studies.

For future research, we consider it as highly important to be aware of the complexity of PA behavior and its distinct domains and intensities and to carefully choose respective assessment tools. Although a plethora of validated PA scales exists, almost 32% of the included studies did not specify, which questionnaires were used. Relying on validated scales that are able to differentiate between various modes of PA rather than on *on-the-fly* creations [148] may facilitate comparability across studies in the future. Moreover, it might be beneficial to combine objective and subjective PA assessment tools in order to measure PA levels, behavioral patterns, and subjective perceptions to fully understand how and why behavior changes.

The vast majority of studies were prospective longitudinal. These designs allow to identify patterns within populations and reveal relationships between life events and transitions and PA behavior. However, two issues might limit the informative value of prospective longitudinal studies. First, long periods between follow-up assessments pose a challenge to the identification of the exact timing of a life event meaning that immediate effects might remain hidden. Additionally, changes in PA levels could also be influenced by other circumstances and events that occurred within this period but were not assessed specifically. Second, if follow-up times are rather short, long-term developments and rebound or readjustment effects remain concealed.

To counteract these two potential limitations, prospective longitudinal studies should ideally use repeated measures over an extended follow-up time in order to capture life events and transitions in their temporal complexity and to account for both immediate and more persistent effects. Here, a temporal division of transition periods may be helpful. Studies on retirement, pregnancy, or menopause have shown that a distinction in a period before (pre), around (peri), and after an event (post) is beneficial in order to better understand the long-term trajectories of behavioral pathways. The temporal fragmentation in three phases may also help to assess the quality of behavioral changes across a transition, meaning whether a behavior changes in a smooth or rather abrupt fashion.

A further methodological limitation of current research is that most studies did not control for concomitant events but rather focused on singular events. Studies targeting young adulthood in particular have shown that this is a developmental period, which is prone to the co-occurrence or accumulation of various life events and transitions, which might all interact in changing PA behavior. A similar challenge that future research will have to deal with is to separate the effects of life events on PA behavior from underlying general trends. It has been widely acknowledged that PA declines with increasing age [149, 150] and that adolescence and young adulthood are periods where steep declines are to be expected [9]. In this regard, PA patterns might change due to biological maturation or other environmental factors that are not necessarily related to life events and transitions. Only few studies (mostly those with a focus on pregnancy, parenthood, and retirement) employed either long-term follow-ups or control groups to monitor these underlying trends. A careful choice of assessment tools, long-term follow-ups, control group designs, and more complex statistical models might be necessary to

disentangle potential interaction effects between different life events and transitions, underlying trends, and other potential mediator or moderator effects (e.g. gender, age, socio-economic status, etc.).

In addition, we advocate that future research should further consider the use of biographical retrospective studies in order to assess life events and their impact on PA from an individualized, yet socio-cultural perspective [31]. It is highly relevant to add explanatory value to the rather descriptive results of prospective longitudinal studies. Biographical analyses may reveal how and why life events become critical events in the sense that they are valued as personally significant [31], how they are perceived and processed, how they account for changes in PA behavior across the life course, and which underlying meaning is attributed to these developments. While reconstructive and self-reported PA data might be limited due to potential recall bias or inaccuracy as well as social desirability [151, 152], the assessment of perceptions and attitudes about behavioral pathways adds another perspective to better understand when and why individuals take up or terminate PA.

With regard to sample characteristics, a total of 20 studies included only females while only two studies included solely men. As for the remaining studies, 17 showed an uneven gender distribution as more than 65% of the sample consisted of women. Our findings indicate that women and men may respond in different ways to certain events and transitions. However, as studies showed great diversity in methodological approaches and sampling, clear gender effects were difficult to identify.

Moreover, most studies examined samples of well-educated people making it difficult to generalize results for other populations. Particularly, research on retirement has shown that job characteristics may have an impact on the way PA behavior evolves across this transition. Therefore, future research should also focus on socioeconomic circumstances and apply a sampling strategy that also takes into account disadvantaged socioeconomic positions.

Limitations of the review

With regard to our review, some limitations occur as well. First, the categorization of life events and transitions into ten thematic categories appeared to be the most reasonable, although we acknowledge that other categorical differentiations might be possible. Nevertheless, considering the heterogeneity of studies, we propose these initial distinctions in order to facilitate the synthesis of results. In this regard, however, a second limitation occurs. While the inclusion of 107 articles assessing 72 different life events and their relationship to various PA domains and intensities is a notable strength for mapping the research landscape on this topic, it also poses a considerable constraint for the depth of our analysis. Thus, the narrative synthesis of results does not reflect the entire complexity of the life event-PA relationship, but rather tries to identify emerging trends and draw out patterns across studies on a more general level. Third, only one author reviewed full-texts for eligibility. To include only studies that fit the inclusion criteria, arguable studies were discussed with a second researcher until consensus was reached. Fourth, we did not conduct a quality appraisal of the included studies. In this regard, studies were given the same weight when scoping the research landscape, although comparability might be limited. Fifth, although we extended the database search of two previous reviews [18, 19], studies that were published in another language or in journals that were not indexed in the databases might not have been found. Through cross-referencing we tried to lower the risk of missing any relevant studies. By focusing on peer-reviewed journal articles, potentially relevant grey literature (e.g. dissertations that are published as monographs) might have been missed. Eventually, by searching for terms such as *life event* or *transition*, studies focusing on certain events and transitions (e.g. parenthood, pregnancy, retirement, etc.) but

not using the terms *life event* or *transition* might have been missed. Again, by cross-referencing, we aimed to lower this particular risk.

Conclusion

This scoping review provides an overview of the current state of research on the impact of life events and transitions on PA and a summary of key findings in this area. Considering the health benefits of regular PA, we argue that it is crucial to understand when and why individuals take up or terminate PA. In this context, life events and transitions can be conceptualized as natural interventions that inevitably occur within the life course and that are oftentimes accompanied by changes in PA behavior for both the better and the worse. Despite some emerging trends, the overall state of research on this topic is still characterized by heterogeneity and fragmentation, which is reflected in a lack of theoretical, conceptual, and terminological clarity as well as in disparate study designs, methods, and reporting. This makes it difficult to synthesize and compare results across studies. Eventually, we hope that our synthesis of the research landscape will help to further develop research practices in the highly relevant fields of PA and sport, health, and leisure studies.

Supporting information

S1 Table. Study characteristics of the 107 included studies arranged by the assessed life event and transition categories.
(DOCX)

S2 Table. Studies assessing the same samples.
(DOCX)

S1 File. Preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews (prisma-scr) checklist.
(DOCX)

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5.4 Article 3: "The role of critical life events in the talent development pathways of athletes and musicians: A systematic review"

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The role of critical life events in the talent development pathways of athletes and musicians: A systematic review

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ABSTRACT

Objectives: The experience of critical life events may be crucial for talent development. Critical life events can shape individual biographies and are landmarks in defining narrative identities. However, there is a lack of systematic research on life events in the context of talent development. With this systematic review, we synthesize the literature on the role of critical life events in the biopsychosocial developmental pathways of athletes and musicians.

Method: The systematic review was informed by the PRISMA guidelines. The identified literature was appraised with the Mixed Methods Appraisal Tool. Additionally, we conducted a thematic network analysis.

Results: Thirty-six studies met the inclusion criteria. Three thematic networks emerged from the findings: Types of life events; coping strategies; and impact of life events on the developmental pathway. The findings suggest that critical life events are not necessarily traumatic or hinder the biopsychosocial development of athletes and musicians. Performers can benefit from various life events with regard to their development - dependent on the coping strategies employed.

Conclusions: Against the background of our findings, practitioners should consider to systematically use the benefits of challenges. These should be explicitly career-related, manageable, and focused on the refinement of skills.

By thematically synthesizing findings from qualitative and quantitative studies, we provide a practical understanding about the impact of life events on developmental pathways of elite athletes and musicians. Our findings support a broad conceptualization of giftedness, underscoring the idea that critical life events have an impact on the dynamic pathway to excellence in different achievement domains.

1. Introduction

Why do some people fulfill their potential and perform at high levels whereas others seem to never peak and remain at much lower levels? For nearly two centuries, this question has been heavily debated as part of the nature-vs.-nurture controversy in research on giftedness. While some researchers focus on the importance of innate abilities for the achievement of excellence, others insist on the importance of environmental factors (Gobet, 2013). The most prominent researcher in the field of expertise research is probably Anders Ericsson. He and his colleagues initiated an ongoing debate when they published the theory of deliberate practice (Ericsson, Krampe, & Tesch-Römer, 1993; Ericsson & Smith, 1991), which emphasizes the essential role of highly structured, domain-specific practice over several years in order to develop expertise. Because deliberate practice is the main predictor for why some individuals achieve excellence and others do not, Ericsson's approach can be seen as an extreme environmental (nurture) position (Starkes, 2000).

Yet, the relationship between practice and performance is rarely linear (Baker, Côté, & Deakin, 2005) and practice is not the only factor to explain excellence. Several reviews have identified a range of environmental factors (e.g., birthplace, family dynamics) that all influence talent development (Baker & Horton, 2004; Li, Wang, & Pyun, 2014). In addition, retrospective studies with Olympic and World champions revealed a variety of non-linear pathways to expert status (Durand-Bush & Salmela, 2002; Phillips, Davids, Renshaw, & Portus, 2010a). Therefore, researchers increasingly agree that excellence emerges through dynamic interactions between multiple components or systems across the lifespan (Bailey & Collins, 2013; Collins, MacNamara, & McCarthy, 2015). In evolving dynamic human systems,

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critical life events are significant developmental components (Den Hartigh, Van Yperen, & Van Geert, 2017). Hence, the development of excellence might, to a relevant extent, be shaped by specific critical life events underscoring the idiosyncratic nature of pathways to excellence (Den Hartigh, Van Dijk, Steenbeek, & Van Geert, 2016).

Whereas many quantitative studies focused on predictors of exceptional performance, little is known about the different kinds of critical life events expert performers in music and sport have encountered on their winding path to the top, and how these may have influenced their development (Peterson, Canady, & Duncan, 2011). Still, knowledge about life events and their impact on the development of gifted individuals can be crucial for researchers and practitioners in order to revise and refine their talent development programs. For this review, we specifically chose music and sport because these high-performance environments share certain commonalities such as the pressure of competition and the high uncertainty of careers. With this review, we systematically synthesize the literature on the role of critical life events in the developmental pathways of elite performers in sports and music. In this regard, we employed a broad search strategy and included studies of various designs and different theoretical and methodological backgrounds. Therefore, our results can help educators and practitioners to systematically refine and individualize talent development programs.

1.1. Theoretical background

Important concepts and terms. Research on talent, giftedness, and the impact of critical life events on talent development suffers from a lack of conceptual clarity. Hence, in the following section, we define the terms and concepts that are relevant for this systematic review.

Giftedness. For the purpose of this review, we adopted a broad definition of giftedness, which proved to be useful across all domains of human endeavor. Subotnik, Olszewski-Kubilius, and Worrell (2011) construed giftedness as the manifestation of a performance that is at the upper end of the range in a certain talent domain. Giftedness is not limited to academic achievements only, but also encompasses other domains such as sports, music, arts etc. While in childhood, giftedness can actually only be evaluated by potential, the measure of giftedness in later stages of a career is achievement (Olszewski-Kubilius & Thomson, 2015). Informed by this broad definition of giftedness, we argue that gifted individuals who attained extremely high levels of success in their careers are thereby not only experts in their respective domain, but also experts in persisting through adversity, maintaining motivation in challenging times, and dealing with obstacles that inevitably arise during a career.

Life experience, lived experience, and critical life event. Every life story is characterized by a unique sequence of experiences, by drawbacks and progress, insights and outlooks, demands and overloads, wins and losses, daily hassles and big events, and transitions (Hinske, 1986). Life events and life experiences are part of the human life course (Runyan, 1982), and have been interpreted in multiple ways. The terms life experience and lived experience encompass a broad spectrum of positive and negative experiences relevant for individual development (Coleman, Robins, Micko, & Cross, 2015; Guptill, 2011). In phenomenological research, it is preferred to refer to the term lived experience, as opposed to life experience, in order to emphasize subjectivity and the embeddedness of experiences in the individual's life world (Finley, 2009). Critical life events differ from the wide spectrum of life experiences as they exceed the common horizon of expectations and experiences, are not part of everyday life, and are accompanied by extreme emotions (Filipp & Aymanns, 2010). By disrupting the balance between the individual and its environment, critical life events derange our everyday patterns of behavior and cognitions. They put us off our paths, thwart our plans, and lead us to question our most fundamental beliefs (Filipp & Aymanns, 2010).

Critical life events can be both conceptualized from a stress-theoretical or a developmental viewpoint. From a stress-theoretical perspective, critical life events are stressors that trigger or solidify psychological disorders and illnesses. In contrast, the lifespan developmental perspective construes critical life events as disruptions in the life course. The main interest of this second theoretical perspective lies in studying adaptive dynamics following events; hence, processes of change are the variable of interest. From a developmental perspective, life events affect the whole person and eventually result in change of the whole person (Filipp & Aymanns, 2010). Whether an event is significant, depends on the individual – who is situated in a specific life context – and his or her specific vulnerabilities and resources. Thus, the meaning attached to an event is largely influenced by the individual's appraisal of the event and not by the event itself. This subjectivity inherent to critical life events, however, impedes their investigation.

Transition. Wippert (2011) noted that in North-American research, the term life event implies a dramatic change in life circumstances with sometimes traumatic consequences, whereas in the European research tradition, it is more common to use the term transition instead of life event. The implicit difference between these understandings is not only the graveness of an event, but also the event-related construction of time.

Events have to be differentiated according to their timing and time-course, depending on whether they are construed as abrupt disruptions, as end points of processes of change, or as transitions without a specific start and end point. In her seminal paper, Schlossberg (1981) argued that viewing life events only as markers in life histories underestimates the context of these events. In her opinion, the term transition is more suitable for events or non-events that result in a change of assumptions and social networks, and result in either growth or deterioration. Not the transition itself is of primary importance, but rather how that transition fits with an individual's life situation at the time of transition (Schlossberg, 1981); hence, transitions are not so much a matter of 'real' change as of the individual's perception of change. Conceptualizing important events as transitions places a greater emphasis on the process character of an event instead of depicting an event as an on-or-off phenomenon.

Adversity. All previous concepts (critical life event, life experience, lived experience, and transition) denote the relational nature of an individual's appraisal of events or experiences in his or her life. Events and experiences have to be of personal significance to be considered life events or life experiences.

Adversity is a state of hardship or suffering associated with trauma, distress, difficulty, or negative events or experiences (Tugade & Fredrickson, 2004). Adversity is located at the more severe end of the life experience continuum, evokes strong discomfort, and leads individuals to question deep-rooted beliefs. The emphasis is shifted to the relational state between an individual and its environment, as opposed to stressors which are simply defined as environmental demands encountered by an individual (Fletcher, Hanton, & Mellalieu, 2006).

The relevance of critical life events for talent development. To fully understand and support the development of gifted individuals in the performance domains of sports and music, it is important to examine both their developmental pathways and the range of factors that may positively or negatively impact development (Collins et al., 2015). Without doubt, critical life events are important parts of an individual's life, and therefore need to be conceptualized as essential components of the talent development process (Subotnik et al., 2011). This assumption is in congruence with dynamical systems theory, a contextual and dynamic framework, which attaches importance to the timing of experiences and exposure to certain events as crucial factors for developmental trajectories and pathways (Dai & Renzulli, 2008; Davids & Baker, 2007; Phillips, Davids, Renshaw, & Portus, 2010b).

The review aims to examine the role of critical life events in the developmental pathways of athletes and musicians. In many respects, music and sports seem to be quite disparate, but athletes and musicians may encounter similar critical life events on their respective paths to

the top. From a psychological perspective, music and sport performance also share commonalities (MacNamara, Holmes, & Collins, 2006). Performers in both domains need to exhibit full-time commitment in order to develop high-level skills and transform their potential into achievement. They are both subjected to challenges of competition and uncertainty of their careers and need to cope with setbacks they encounter along their way (MacNamara et al., 2006; Martin, 2008). Over the last two decades, interest in the effective development of talent has grown in many countries (Baker, Cobley, Schorer, & Wattie, 2017). Yet, every talent development program can only be as successful as it is related to the real life circumstances of those identified as talented. Against this background, we argue that the study of critical life events and their impact on talent development is of a very high practical relevance. Critical life events can shape individual biographies, are often landmarks in defining narrative identity, and affect mental and physical health to a large extent (Schwarzer & Luszczynska, 2012).

To the knowledge of the authors, no other systematic review on the impact of critical life events on the development of gifted individuals in sports, music, or other performance domains has been conducted so far. Based on the high practical relevance and the importance of critical life events for development, we conclude that there is a need for a more systematic understanding of the role of critical life events for the development of expert performers in sports and music.

In our review, we aim to (a) critically appraise existing research on the impact of critical life events on the development of expert performers; (b) compare different talent development domains (sports and music) in this regard; and (c) identify desiderata in the research on talent development. More specifically, we aim to address the following, overall research question: To what extent do critical life events have an impact on the developmental pathways of gifted individuals in the performance domains of sports and music? To answer this question, we analyze which life events are currently referred to in the literature on talent development and examine associated coping mechanisms of athletes and musicians. In our review, we do not only assess performance-related development but employ a holistic approach by focusing on the biopsychosocial development of expert performers.

2. Approach

The method for this systematic review was informed by the preferred reporting items for systematic review and meta-analysis (PRISMA) guidelines (Moher et al., 2015; Moher, Liberati, Tetzlaff, Altman, & Prisma Group, 2009). However, it needs to be stressed that the PRISMA statement was primarily developed for the reporting on quantitative health care evidence targeting study designs such as randomized control trials. Due to the exploratory nature of our review, which can be classified as a systematic mixed studies review (Pluye & Hong, 2014) entailing the synthesis of data and results from studies with diverse designs, not all items of the PRISMA checklist are applicable. We aimed to use the PRISMA statement as a guideline to increase the methodological rigor and quality of our review and tried to follow the guideline's suggestions as much as we felt was possible for the kind of review we conducted.

2.1. Search strategy

We identified relevant work through the following process: (1) searching e-journal databases (SportDiscus, Web of Science, Pubmed, PsycInfo, PsycArticles, RILM Abstracts of Music Literature, SpoLit, ERIC); (2) screening of reference sections of eligible studies; and (3) applying further searches using GoogleScholar to ensure that no key papers were omitted.

Table 1 shows the search terms, with set #3 yielding the initial search results from which studies were then selected. Search terms were agreed to a priori, and were intentionally broad to reduce the risk of removing relevant studies and to do justice to the wide range of theoretical concepts that address critical life events. To capture all relevant previous research, no publication date limitation was set. The search was conducted on January 31, 2018.

2.2. Inclusion and exclusion of studies

Inclusion criteria for each stage were specified in advance. We deployed the following inclusion criteria: (a) papers were published in English or German; (b) papers were original, peer-reviewed articles; (c) full-text was available; (d) papers were either of qualitative, retrospective design or of quantitative, prospective design; and (e) papers must present data on life events, and on the impact of these events on the developmental pathways, or on other events that potentially influence biopsychosocial development.

Studies with adolescent elite athletes or musicians were only included if the performers were competing at an international level, were members of the age-relevant national team, or studied at sports or music schools to which admission is based on athletic or musical success. Since the measure of giftedness at later stages of a career is achievement (Subotnik et al., 2011), the adult athletes in original studies had to compete at least at the national level or in the NCAA division I. The reasoning behind the latter is that the collegiate sport system in the United States is very competitive and the top sport universities competing in the division I of the NCAA have a tradition of excelling in sports and could be argued to be relatively elite (see Swann, Moran, & Piggott, 2015). For adult musicians, it is even more difficult to set specific performance criteria for elite status. Here, we only included studies that examined professional instrumentalists or singers since it can be reasonably assumed that their level of performance is at the upper end in their respective talent domain.

We excluded studies if they (a) were not related to musicians or athletes; (b) did not examine the talent development process; (c) solely examined the singular coping with a life event without considering the impact of the event on development; (d) examined career termination; (e) included only subjects that were not the gifted individuals themselves but other individuals such as parents, teachers, coaches, siblings, or friends etc.; and (e) had a cross-sectional study design.

2.3. Sifting articles and study eligibility

The sifting process consisted of three stages (see Fig. 1); we first screened papers by title, then by abstract, and finally by full-text.

At each stage, articles that did not meet the inclusion criteria were excluded (reasons for full-text rejection are available from the first author). A peer-review team was established to increase methodological rigor. Peer-debriefings determined the eligibility of inclusion of the final studies. When there were disagreements about the eligibility of particular articles, agreement was reached through a process of constructive debate.

2.4. Data extraction and synthesis of study results

The first step of the data analysis was reading each study several times to become deeply familiar with the research context, findings, and inferences. The extracted data included sample characteristics, data collection tools, research methodology, main findings, and the country in which the study was conducted (see supplementary Table 1).

In accordance with the PRISMA protocol, given the heterogeneity of the included study designs, two researchers independently assessed the risk of bias of all included studies using the Mixed Methods Appraisal Tool (MMAT; Pluye et al., 2011). The MMAT demonstrates excellent inter-rater reliability (Pluye & Hong, 2014) and has been recognized as the most reliable tool for appraising mixed methods research (Crowe & Sheppard, 2011). The updated version of the MMAT (Pluye et al., 2011) consists of four criteria for the evaluation of qualitative studies (such as the extent of reflexivity; see supplementary Table 2) and four criteria

Table 1
Search terms for the literature search.

Set	Search Terms
#1	"life event" OR "life events" OR "life experience" OR "life experiences" OR "lived experience" OR "lived experiences" OR adversity OR transition* OR "biographical disruption" OR "biographical disruptions" OR "disruptive experience" OR "disruptive experiences" OR "empowering experience" OR "empowering experiences" OR "disruptive event" OR "disruptive events" OR "empowering event" OR "empowering events" OR "positive experience" OR "positive experiences" OR "positive event" OR "positive events" OR "negative experience" OR "negative experiences" OR "negative event" OR "negative events" OR "childhood experience" OR "childhood experiences"
#2	athlete OR musician
#3	#1 AND #2

for different types of quantitative studies (e.g., sampling strategy; see supplementary Table 2). Three criteria are applied to mixed-methods studies. The final outcome of the MMAT is a star (*) rating ranging from zero to four stars depending on the number of criteria achieved. The outcome of the quality appraisal can also be reported as a percentage value ranging from 0 to 100 with 25% increments (Pace et al., 2012). The higher the number of stars or the higher the percentage value, the higher the methodological quality of the study and the lower the risk of bias. In accordance with recent systematic mixed studies reviews in the field of sport psychology (see Forsdyke, Smith, Jones, & Gledhill, 2016; Gledhill, Harwood, & Forsdyke, 2017), the research team agreed on the following thresholds for risk of bias in reporting: 0–24% = high risk of bias; 25–49% = high to moderate risk of bias; 50–74% = moderate to low risk of bias; and 75–100% = low risk of bias.

As Melterud (2001) and Tracy (2010) have pointed out, there is some debate over the concept of risk of bias and the use of criterion-based approaches to assess the methodological quality of qualitative research. However, lack of reporting on philosophical assumptions, existing preconceptions, and lack of discussing elements of reflexivity are all examples of increasing risk of bias in qualitative studies (Gledhill et al., 2017; Melterud, 2001) and are assessed with the MMAT. Nevertheless, it is important to keep in mind that the MMAT is solely used to assess methodological quality against a set of pre-determined criteria. It does not infer the overall quality of a research paper.

We used convergent thematic analysis (CTA) to synthesize data (Hong, Pluye, Bujold, & Wassef, 2017). A CTA includes the identification of the main or recurring themes from a body of research and is usually used to detect, group, and summarize findings from studies (Dixon-Woods, Agarwal, Jones, Young, & Sutton, 2005; Pluye & Hong, 2014). Due to its narrative approach, CTA can handle qualitative and quantitative findings, and allows to organize and summarize findings from a large and diverse body of evidence. In line with Butler, Hall, and Copnell (2016), we defined qualitative data as first order constructs (quotes of participants) and second order constructs (researcher interpretation, statements, ideas). By extracting both types of data, it was ensured that the review findings were thoroughly grounded in the participants' original experiences.

To circumvent the limitations of thematic analyses in systematic reviews, such as the lack of clarity about what thematic analysis involves and the processes by which it can be achieved (Dixon-Woods et al., 2005), we conducted a thematic network analysis based on the work by Attride-Stirling (2001). Thematic network analysis was

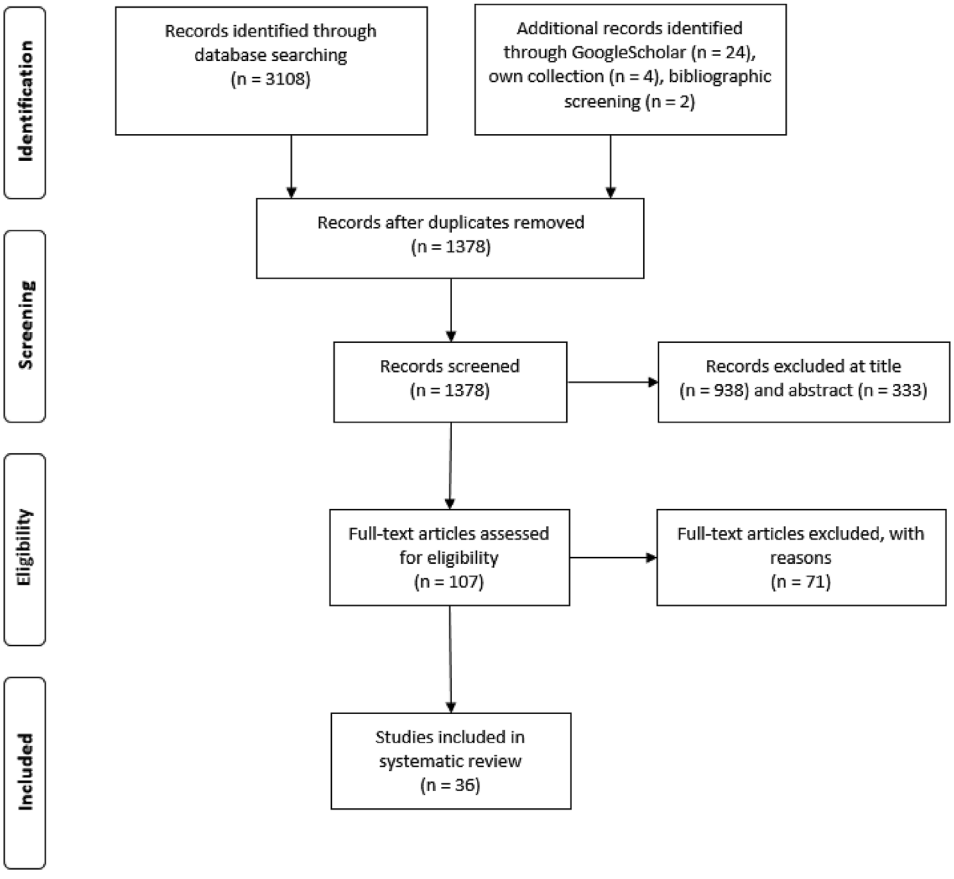

Fig. 1. PRISMA flow diagram.

originally developed for analyzing qualitative research, but it can be applied to systematic mixed studies reviews in order to thematically synthesize findings from a diverse body of evidence. Based on constant comparative analysis, the data from the included studies were organized by identifying recurrent *basic themes* and patterns. Basic themes were summarized by more abstract *organizing themes*. The research team reached consensus on the main thematic clusters within the data. These main themes were used as so called *global themes*, which summarize all organizing and basic themes. Eventually, three global themes were defined to give an idea of the patterns in the data with regard to the possible impacts of life events on the developmental pathways of gifted individuals.

3. Findings

3.1. Literature identification

Database searching produced a total of 3108 results. Additional records were identified through GoogleScholar ($n = 24$), searching in own collections ($n = 4$), and bibliographic screening of reference sections ($n = 2$). Following the application of inclusion criteria and the methodological quality assessment, 36 studies were deemed eligible for inclusion (see Fig. 1), 31 of which focused on sports, four on music, and one on both, sports and music. Amongst these, 25 articles were of qualitative design, 10 were quantitative, and one was of a multiple methods design.

3.2. MMAT appraisal

For quantitative studies, methodological quality ranged from 50% to 100% ($M = 75.0\%$). For qualitative studies, methodological quality ranged from 50% to 100% ($M = 68.0\%$). The multiple methods study obtained a methodological quality score of 75% for both parts – the qualitative and quantitative part respectively (see supplementary Table 2).

Applying the MMAT quality criteria indicated that quantitative studies reported their samples and sampling strategies with clarity, but the response rates less so. Additionally, most quantitative studies did not explain their use of measurements. Retrospective interview designs were prominent in the qualitative studies. Utilizing the MMAT quality criteria, we noticed that only a few studies critically explained how findings related to the perspective, role, and interactions of the researchers with the participants. The researchers' role during all stages of the study process (formulating research questions, data collection, data analysis, and interpretation of findings) was often not clearly articulated. Furthermore, most qualitative studies did not explain the study context (i.e., location where interviews were conducted) and how findings might relate to the context.

3.3. Demographic characteristics

Participants were 1700 athletes and 76 musicians. Table 2 contains a detailed demographic breakdown. We did not report results related to other social agents if they were included in the studies because the review aimed to focus on the impact of critical life events on the biopsychosocial development as perceived by athletes or musicians themselves. The reviewed studies ($N = 36$) gleaned data of participants in: Australia ($n = 3$); Canada ($n = 3$); Finland ($n = 2$); Germany ($n = 2$); Great Britain ($n = 10$); Ireland ($n = 2$); New Zealand ($n = 2$); South Africa ($n = 1$); Spain ($n = 1$); United States ($n = 13$); and country not reported ($n = 3$).[1] Of the 36 studies, 14% ($n = 5$) reported ethnicity of the participants, 14% ($n = 5$) reported ethnicity only of certain subgroups, and 72% ($n = 26$) did not report ethnicity.

[1] Some studies were multi-nation studies, hence the disparity between total number of studies and countries represented.

3.4. Convergent thematic analysis

Three key themes emerged from synthesizing the findings of included studies: (1) Types of life events; (2) Coping strategies; (3) Impact of life events on the developmental pathway. Whereas the global theme types of life events summarizes the variety of critical life events the original studies reported, the theme coping strategies describes the ways in which performers attempted to deal with those events. The third thematic network presents the impact of critical life events on the developmental pathway – mainly from the subjective, retrospective, and reflective perspective of the performers by linking life events and subsequent coping responses to development. In this regard, our thematic networks present a thematic analysis of the main themes of the included studies, and also the chronological pattern occurring from the onset of a life event-related experience to the perceived impact of those events on the developmental pathway. The thematic networks are presented in Figs. 2, 3, and 4. In the following paragraphs, we report on the specific findings of the included studies.

Theme one: Types of life events. In our analysis, we identified a variety of critical life events that potentially influence the developmental pathways of musicians and athletes. We classified these events into (a) events outside the performance domain, (b) health problems, and (c) events inside the performance domain (see Fig. 2).

a) 'Events outside the performance domain' included life events related to *family dysfunction*, such as the divorce of parents (Aarresola, Itkonen, & Laine, 2017; L.; Hardy et al., 2017; Richardson, Littlewood, Nesti, & Benstead, 2012), witnessing abuse in the family (L. Hardy et al., 2017), having an absent (Howells & Fletcher, 2015), or alcoholism of one parent (L. Hardy et al., 2017). While family dysfunction encompassed events during childhood, *relational issues* usually occurred later. Examples were maternity (Martinez-Pascual, Alvarez-Harris, Fernandez-De-Las-Penas, & Palacios-Cena, 2014), partner becoming pregnant (Wadey, Evans, Hanton, & Neil, 2012), partner having an abortion (Wadey et al., 2012), and the breakup of a romantic relationship (L. Hardy et al., 2017; Wadey et al., 2012). Studies conducted with athletes also reported experiences of bullying (L. Hardy et al., 2017; Tamminen, Holt, & Neely, 2013) and sexual, physical, and verbal abuse (L. Hardy et al., 2017; Tamminen et al., 2013) by either coaches or parents (basic theme *abuse*). *Personal tragedies* ranged from serious illness of a family member (Aarresola et al., 2017; L.; Hardy et al., 2017; Howells & Fletcher, 2015; Wadey et al., 2012) to death of a family member (Aarresola et al., 2017; L.; Hardy et al., 2017; Howells & Fletcher, 2015; Morgan & Giacobbi, 2006; Sarkar, Fletcher, & Brown, 2015; Wadey et al., 2012), or death of a close friend (Wadey et al., 2012). In one study (Sarkar et al., 2015), political unrest (basic theme *global tragedies*) was identified as a significant life event with an impact on the developmental pathway.
b) 'Health problems' encompassed psychological states, embodied states, and developmental disorders. Performers perceived various psychological states as critical life events such as eating disorders (Howells & Fletcher, 2015; Tamminen et al., 2013), disordered eating (Howells & Fletcher, 2015), burnout (Fraser-Thomas & Cote, 2009), depression (Howells & Fletcher, 2015; May, Veach, Reed, & Griffey, 1985), suicidal thoughts (Howells & Fletcher, 2015), and self-harm (Howells & Fletcher, 2015). Embodied states were particularly characteristic of careers in sports and music. Performers reported general health issues (Daykin, 2005), growth problems (Schubring & Thiel, 2014a; Schubring & Thiel, 2014b), injuries (Aarresola et al., 2017; Beltman & Voet, 2007; Brown, Lafferty, & Triggs, 2015; Burton, Van Heest, Rallis, & Reis, 2006; Collins et al., 2015; Cresswell & Eklund, 2006; Fraser-Thomas & Cote, 2009; Galli & Reel, 2012; Guptill, 2012; L.; Hardy et al., 2017; Howells &

Table 2
Demographic analysis.

Participants	*n*	% of total participants (N = 1776)	Level
Male athletes	946	53.3	Club level to Olympic champions
Female athletes	676	38.1	Club level to Olympic champions
Gender not specified athletes	78	4.4	National youth squad members to senior international level
Male musicians	46	2.6	Precocious boys from a prestigious Choir school to professional musicians
Female musicians	20	1.1	Amateurs in top level community ensembles to professional musicians
Gender not specified musicians	10	0.6	Professional musicians

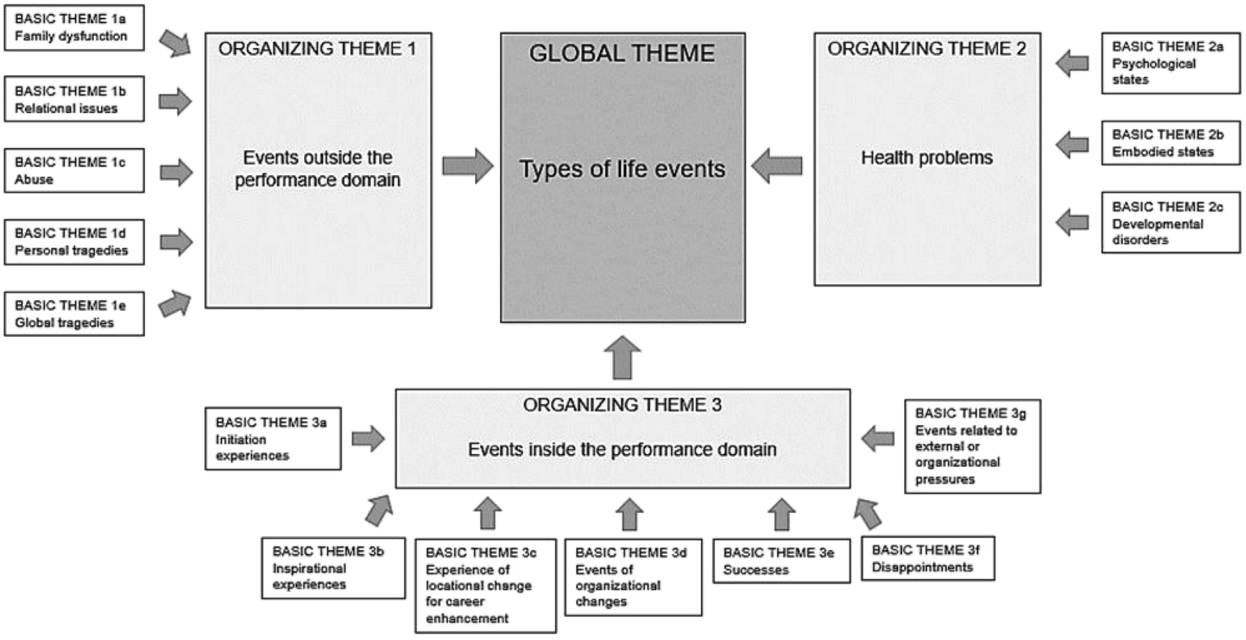

Fig. 2. Thematic network one: Types of life events.

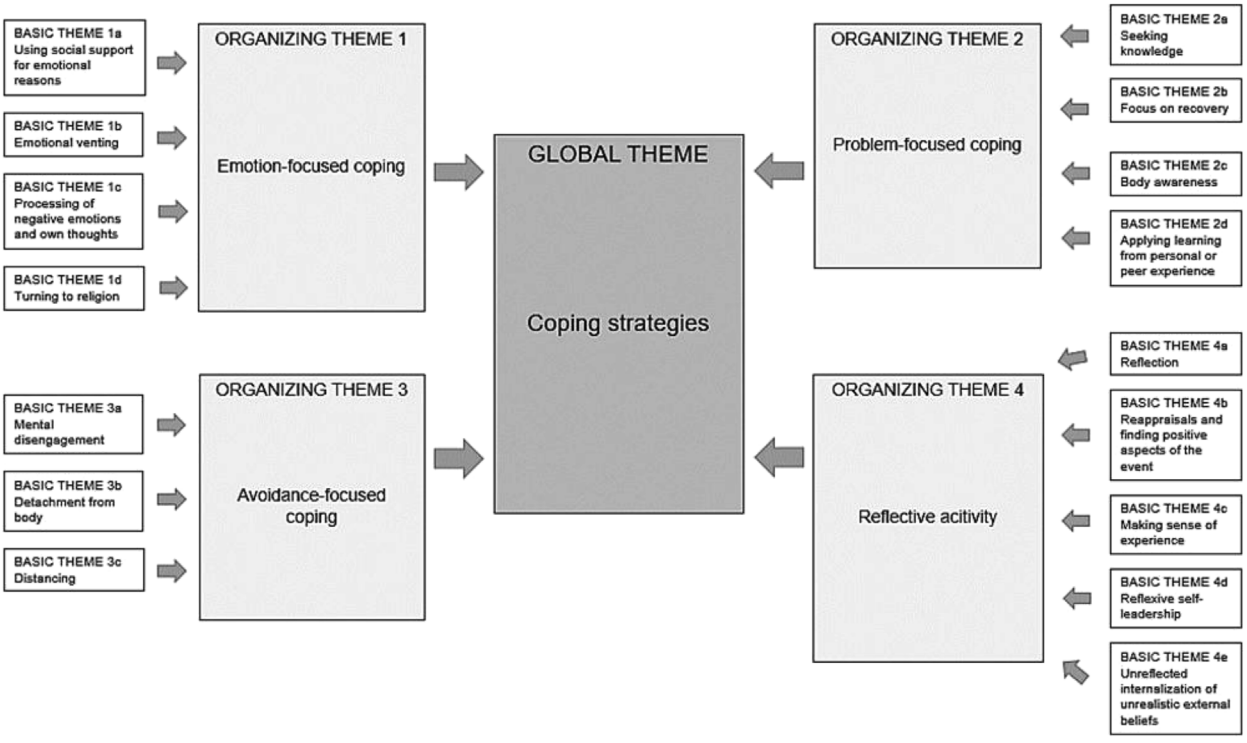

Fig. 3. Thematic network two: Coping strategies.

Fig. 4. Thematic network three: Impact of life events on developmental pathway.

Fletcher, 2015; Morgan & Giacobbi, 2006; Richardson et al., 2012; Roy-Davis, Wadey, & Evans, 2017; Ryba, Ronkainen, & Selanne, 2015; Sarkar et al., 2015; Savage, Collins, & Cruickshank, 2016; Tamminen et al., 2013; Udry, Gould, Bridges, & Beck, 1997; Wadey, Evans, Evans, & Mitchell, 2011; Wadey et al., 2012), surgeries (Burton et al., 2006; Collins et al., 2015; Morgan & Giacobbi, 2006), and illnesses (Aarresola et al., 2017; Collins et al., 2015; Fraser-Thomas & Cote, 2009; Howells & Fletcher, 2015; Savage et al., 2016; Wadey et al., 2012) as critical life events that influenced their career. Developmental disorders comprised dyslexia (Howells & Fletcher, 2015), attention deficit hyperactivity disorder (Howells & Fletcher, 2015), and obsessive compulsive disorder (Howells & Fletcher, 2015).

c) Regarding 'events inside the performance domain', *initiation experiences* that got participants started in the respective domain were constitutive of the developmental pathway. Such events were discovering one's talent (Freeman, 1999), being identified as talented (Coulson, 2010; Ryba et al., 2015), initiation to organized sport (Aarresola et al., 2017), finding sport (L. Hardy et al., 2017), selecting one's primary sport (Aarresola et al., 2017), and finding one's coach, teacher, or mentor (Coulson, 2010; L.; Hardy et al., 2017). Well-remembered *inspirational experiences* involved meeting a role model (L. Hardy et al., 2017), watching an inspirational performance (L. Hardy et al., 2017), or listening to a specific piece of music (Freeman, 1999). *Locational changes for career enhancement* were remembered as critical events in their lives by performers in both sports and music, which all went to great lengths to enhance their careers. Examples were migratory transitions (Brown et al., 2015; Richardson et al., 2012; Ryba et al., 2015), travelling abroad for tuition (Coulson, 2010), moving away from home at a young age (Burton et al., 2006; L.; Hardy et al., 2017), or applying and subsequently moving to a sports school (Aarresola et al., 2017). *Events of organizational changes* included the change to another sport or instrument (Beltman & Voet, 2007), transitions between competitions in different leagues (Cresswell & Eklund, 2006), and switching to a new coach or training group (L. Hardy et al., 2017). *Success* was identified as a critical life event by the performers in a variety of manifestations. Athletes mentioned early success (Aarresola et al., 2017; Burton et al., 2006; Morgan & Giacobbi, 2006), progress in ability-based groups (Aarresola et al., 2017), making their first team debut (Richardson et al., 2012), receiving a personal recognition (Aarresola et al., 2017), being selected for a team (Aarresola et al., 2017), and recruitment for the national team (Burton et al., 2006). *Disappointments* were also mentioned in manifold forms; these included performance setbacks (Aarresola et al., 2017; Brown et al., 2015; Tamminen et al., 2013; Wadey et al., 2012), failure in important music exams or competitions (Beltman & Voet, 2007; Burton et al., 2006; L.; Hardy et al., 2017; Sarkar et al., 2015), major mistakes in competitions (Wadey et al., 2012), not attaining goals (Wadey et al., 2012), nonselection (Collins et al., 2015; L.; Hardy et al., 2017; Sarkar et al., 2015), and deselection (Collins et al., 2015; Wadey et al., 2012). Not least, performers perceived *events related to external or organizational pressures* as critical events in their lives. Examples were: events in which they felt pressured from media (Cresswell & Eklund, 2006); conflicts with coaches (Morgan & Giacobbi, 2006; Tamminen et al., 2013); events in which pressure on unrealistic, unhealthy body ideals was placed on them (Burton et al., 2006); inadequate breaks between seasons (Cresswell & Eklund, 2006); events of excessive stress from parents (Morgan & Giacobbi, 2006); and funding issues (Burton et al., 2006).

Theme two: Coping strategies. Our systematic review revealed that certain forms of coping with critical life events can have a significant impact on the subsequent career-related development. In our thematic analysis of reviewed papers, we identified four, clearly distinguishable coping strategies, namely (a) emotion-focused coping, (b) problem-focused coping, (c) avoidance-focused coping, and d) reflective activity (see Fig. 3).

a) 'Emotion-focused coping' was particularly characterized by strategies related to *social support.* Participants reported that they realized the importance of social support (Morgan & Giacobbi, 2006; Savage et al., 2016; Tamminen et al., 2013; Wadey et al., 2012), sought support for emotional reasons (Howells & Fletcher, 2015; Roy-Davis et al., 2017), and mobilized their social support system (Brown et al., 2015; Savage et al., 2016; Wadey et al., 2011; Wadey et al., 2012). Another emotion-focused coping strategy was *emotional venting* (Roy-Davis et al., 2017; Udry et al., 1997), which specifically included self-disclosure (Wadey et al., 2011), and confiding in others (Wadey et al., 2012). Two other strategies in the emotional domain involved the *processing of negative emotions and own thoughts* (Howells & Fletcher, 2015; Roy-Davis et al., 2017; Sarkar et al., 2015), and *turning to religion* (Roy-Davis et al., 2017).

b) Apart from strategies aimed at handling emotions in the aftermath of critical life events, we identified 'problem-focused coping' strategies. Performers actively *sought knowledge* (Roy-Davis et al., 2017) by searching books (Wadey et al., 2011), adopting a lifelong learning mindset (Coulson, 2010), and attempting to deal with injuries from a medical perspective (Schubring & Thiel, 2014a; Wadey et al., 2012). Especially when sidelined with injuries, problem-focused coping was directed towards the *recovery* process, and characterized by actively planning recovery (Roy-Davis et al., 2017), adhering to the rehabilitation program (Brown et al., 2015; Wadey et al., 2011; Wadey et al., 2012), seeking support for instrumental reasons (Roy-Davis et al., 2017), and attending training sessions as a spectator (Wadey et al., 2011). Increased *body awareness* was also mentioned as a strategy to deal with the consequences of injuries. Athletes and musicians adopted an internal focus on their own personal performance (Brown et al., 2015), and decided to accept and care for their body's needs (Daykin, 2005; Guptill, 2012; Schubring & Thiel, 2014a). By *applying learning from personal or peer experience* (Morgan & Giacobbi, 2006; Savage et al., 2016), expert performers were able to deal with the consequences of critical life events in a problem-focused manner.

c) Whereas the previous strategies were related more or less to a positive impact on the developmental pathway, 'avoidance-focused coping' frequently led to unfavorable consequences, such as injuries, re-injuries, or performance decrements. *Mental disengagement* involved going out (Wadey et al., 2012), watching TV (Wadey et al., 2012), or self-imposed additional training sessions (Morgan & Giacobbi, 2006; Schubring & Thiel, 2014a; Schubring & Thiel, 2014b; Wadey et al., 2012). When injured, some performers attempted to ignore or conceal their pain (Schubring & Thiel, 2014b) (basic theme *detachment from body*). The basic theme *distancing* comprised findings showing that performers tried to distance themselves from problematic experiences in an attempt to maintain normality (Howells & Fletcher, 2015; Schubring & Thiel, 2014a; Wadey et al., 2012), or transferred all responsibility to medical professionals (Schubring & Thiel, 2014a).
d) Finally, 'reflective activity' emerged from the findings of the original studies as a relevant coping strategy. *Reflection* was mentioned as an integral cognitive process mediating between the experience of critical life events and the perceived influence on development. In some studies, reflection was reported very broadly (Sarkar et al., 2015; Savage et al., 2016; Tamminen et al., 2013; Wadey et al., 2011), whereas in other studies, it was specified whether participants reflected on past experiences with adversity (Brown et al., 2015; Roy-Davis et al., 2017), reflected on previous successful transitions (Richardson et al., 2012), recalled their hopes and aspirations (Roy-Davis et al., 2017; Wadey et al., 2012), or thought through reasons for participating in sports or music (L. Hardy et al., 2017; Martinez-Pascual et al., 2014; Tamminen et al., 2013). Another important component of reflective activity were *reappraisals*, especially after negatively perceived life events. Examples were reappraising or reframing the significance of the event (Savage et al., 2016; Wadey et al., 2012), searching for and identifying positive aspects of the event (Roy-Davis et al., 2017; Wadey et al., 2012), developing a positive perspective on the encountered challenges (Beltman & Voet, 2007; Collins et al., 2015), and questioning the performance narrative (Howells & Fletcher, 2015). Closely related to this strategy were searching for meaning (Collins et al., 2015; Howells & Fletcher, 2015; Roy-Davis et al., 2017; Sarkar et al., 2015; Tamminen et al., 2013), and finding meaning (Collins et al., 2015; Schubring & Thiel, 2014b) – examples of the basic theme *making sense of experience*. We also identified a variety of *reflexive self-leadership* strategies in the data, such as self-discipline (Schubring & Thiel, 2014a), self-criticism (Collins et al., 2015), self-observation (Daykin, 2005), self-awareness (Burton et al., 2006), and self-evaluation (Burton et al., 2006; Daykin, 2005; Savage et al., 2016). In one study, participants reported that they *unreflectively internalized unrealistic external beliefs* (Cresswell & Eklund, 2006), which negatively impacted development.

Theme three: Impact of life events on developmental pathway. Performers identified several potential consequences of critical life events for their developmental pathways. These are depicted in the global theme impact of life events on developmental pathway (see Fig. 4). We identified two organizing themes, namely (a) adversarial growth and (b) consequences related to the performance domain.

a) Some studies explicitly investigated 'adversarial growth', whereas others did not explicitly focus on this topic, but it implicitly emerged from the data. *Personal growth* was evident in the data when performers described personality changes as a result of being confronted and dealing with critical life events. Examples were changes related to maturity (Udry et al., 1997; Wadey et al., 2012), confidence (Coulson, 2010; Freeman, 1999; Udry et al., 1997; Wadey et al., 2011), patience (Udry et al., 1997), independence (Aarresola et al., 2017; L.; Hardy et al., 2017; Udry et al., 1997), optimism (Udry et al., 1997), time management (Martinez-Pascual et al., 2014; Udry et al., 1997), self-understanding (Burton et al., 2006; Schubring & Thiel, 2014b), responsibility (Aarresola et al., 2017; Morgan & Giacobbi, 2006; Richardson et al., 2012), and competitiveness (Brown et al., 2015; Burton et al., 2006; Morgan & Giacobbi, 2006). Additionally, performers frequently reported that they gained perspective (Udry et al., 1997; Wadey et al., 2011) after experiencing negatively perceived life events. Gaining perspective was manifested in statements such as appreciating sports and the role of sports in their lives after suffering from injuries (Martinez-Pascual et al., 2014; Tamminen et al., 2013), having a new perspective on problems in the wider scope of life (Morgan & Giacobbi, 2006; Tamminen et al., 2013), acquiring a different perspective on what is important in life (Beltman & Voet, 2007; Burton et al., 2006; Howells & Fletcher, 2015; Morgan & Giacobbi, 2006), having a renewed appreciation for life (Burton et al., 2006; Galli & Reel, 2012; Roy-Davis et al., 2017), feeling uncertain about the future (Brown et al., 2015), recognizing the need for a more balanced life (Beltman & Voet, 2007), accepting injuries or challenges as a normal part of a career (Beltman & Voet, 2007; Richardson et al., 2012; Roy-Davis et al., 2017; Wadey et al., 2012), and viewing future difficult situations as positive and challenging learning experiences (Beltman & Voet, 2007; Brown et al., 2015; Tamminen et al., 2013). We also identified spiritual changes such as finding a deeper meaning in life (Wadey et al., 2012), or increased spirituality (Galli & Reel, 2012; Howells & Fletcher, 2015; Morgan & Giacobbi, 2006) as indicators of personal growth.

A wide array of findings was subsumed under the basic theme *psychological growth*. Here, performers reported increased motivation (Aarresola et al., 2017; Beltman & Voet, 2007; L.; Hardy et al., 2017; Martinez-Pascual et al., 2014; Morgan & Giacobbi, 2006; Sarkar et al., 2015; Savage et al., 2016), increased determination (Collins et al., 2015; L.; Hardy et al., 2017), increased passion (Brown et al., 2015; Burton et al., 2006), greater effort and desire (Sarkar et al., 2015; Wadey et al., 2012), increased commitment to excellence (Aarresola et al., 2017; Freeman, 1999; L.; Hardy et al., 2017; Howells & Fletcher, 2015; Savage et al., 2016), and an increased focus (L. Hardy et al., 2017; Savage et al., 2016; Tamminen et al., 2013) as a result of dealing with adversity during their development. Furthermore, they described psychological strength (Collins et al., 2015; Martinez-Pascual et al., 2014; Tamminen et al., 2013), resilience (Brown et al., 2015; L.; Hardy et al., 2017; Roy-Davis et al., 2017; Wadey et al., 2011), mental toughness (Brown et al., 2015; Richardson et al., 2012; Roy-Davis et al., 2017; Wadey et al., 2011), and a higher capacity for concentrating (Martinez-Pascual et al., 2014). Another component of psychological growth that we identified in the data was related to the self-concept of performers. Exemplary findings were increased self-belief (Brown et al., 2015; Freeman, 1999; Morgan & Giacobbi, 2006; Savage et al., 2016; Wadey et al., 2012), self-awareness (Savage et al., 2016), an improved body-self relationship (Roy-Davis et al., 2017), self-acceptance (Burton et al., 2006; Roy-Davis et al., 2017), development of an athletic identity (Martinez-Pascual et al., 2014; Ryba et al., 2015), improved body-awareness (Guptill, 2012; Udry et al., 1997), and development of more realistic expectations (Udry et al., 1997). Apart from these two growth components that mainly focus on aspects of the self, the theme *social growth* also emerged from the original data. Performers described changes in relationships as a consequence of life events, such as extended social networks (Wadey et al., 2011; Wadey et al., 2012), more positive or stronger relationships with friends, family, and coaches (Howells & Fletcher, 2015; Roy-Davis et al., 2017; Wadey et al., 2011; Wadey et al., 2012), and a detachment from negative relationships (Roy-Davis et al., 2017). Additionally, athletes reported increased empathy (Galli & Reel, 2012; Udry et al., 1997; Wadey et al., 2011; Wadey et al., 2012), and changes in pro-social behaviors (Howells & Fletcher, 2015; Roy-Davis et al., 2017) as a result of critical life

events. They described how they gained a desire to help others in similar circumstances (Tamminen et al., 2013), and how they developed into a more caring (Howells & Fletcher, 2015; Wadey et al., 2011) and unselfish (Wadey et al., 2011) person. Another indicator of social growth was an increased sense of belonging to a team or community (Fraser-Thomas & Cote, 2009; Richardson et al., 2012).

b) We identified 'consequences related to the performance domain' as a second impact on the developmental pathway. In a few studies, performers directly related the experience of critical life events to *changes in skills and performance*. They described superior performances after being confronted with certain life events (Howells & Fletcher, 2015; Martinez-Pascual et al., 2014; Sarkar et al., 2015; Savage et al., 2016; Wadey et al., 2012), creative achievements as a result of changes in practice routines due to injuries (Daykin, 2005), but also inferior performances (May et al., 1985; Schubring & Thiel, 2014a; Wadey et al., 2012). Athletes furthermore reported improved technical and tactical awareness (Richardson et al., 2012; Udry et al., 1997; Wadey et al., 2011), and learning new training methods and techniques (Wadey et al., 2012).
We also identified some *behavioral changes* with a possible impact on the developmental pathway. Performers outlined general changes in practice routines (Brown et al., 2015; Guptill, 2012; Schubring & Thiel, 2014a), increased training loads (Collins et al., 2015; Udry et al., 1997), or more intensive training sessions (Aarresola et al., 2017; L.; Hardy et al., 2017; Udry et al., 1997), or changes in health behaviors (Roy-Davis et al., 2017). Musicians sometimes even changed their instruments after playing-related overload injuries (Daykin, 2005). Beside behavioral changes, athletes also mentioned *physiological changes* as a result of a successful rehabilitation process after injury. In this regard, they reported improved strength, flexibility, body control, fitness, speed, and conditioning (Roy-Davis et al., 2017; Tamminen et al., 2013; Wadey et al., 2011), and a decreased risk of re-injury (Wadey et al., 2011).
Apart from these positive consequences related to the performance domain, the findings of the original studies identified *career-related hardships*. Some performers described that they retired as a result of experiencing negatively perceived life events (Beltman & Voet, 2007; Burton et al., 2006; Howells & Fletcher, 2015), but subsequently came back to sports with a renewed perspective. After experiencing high negative life stress, others suffered from mental health problems which were regarded as significant life events in their own regard. Examples are depression (Beltman & Voet, 2007; Gouttebarge, Tol, & Kerkhoffs, 2016; May et al., 1985; Tamminen et al., 2013; Udry et al., 1997; Wadey et al., 2011; Wadey et al., 2012), feelings of isolation (Tamminen et al., 2013; Udry et al., 1997; Wadey et al., 2012), distress (Gouttebarge et al., 2016), anxiety (Gouttebarge et al., 2016), sleeping disturbances (May et al., 1985), or burnout (Cresswell & Eklund, 2006). Particularly prospective, quantitative studies showed a relationship between high negative life stress and subsequent injuries (Ford, Eklund, & Gordon, 2000; Hanson, McCullagh, & Tonymon, 1992; C. J.; Hardy, Richman, & Rosenfeld, 1991; C. J.; Hardy & Riehl, 1988; May et al., 1985; Petrie, 1992; Petrie, 1993; Petrie, Deiters, & Harmison, 2014), as did some qualitative studies from a more subjective perspective of the athletes (Schubring & Thiel, 2014b; Wadey et al., 2012).

4. Discussion

The process of expert development implies changes at different levels that are not only related to performance but also to psychological, social, and physical aspects of the individual's life. The aim of this systematic review was therefore to comprehensively assess the impact of critical life events on the biopsychosocial development of expert performers by taking a holistic perspective. This aim was underpinned by the following overall research question: To what extent do critical life events have an impact on the developmental pathways of gifted individuals in the performance domains of sports and music? The review was informed by a broad perspective on giftedness considering high-achieving individuals not only as experts in their respective domain, but also as experts in coping with challenges that inevitably arise during development. Furthermore, a dynamic perspective on talent development, which considers critical life events as important factors for development, guided our investigation.

Overall the findings of the review suggest that critical life events impact the biopsychosocial, developmental pathways of athletes and musicians on multiple levels. The reviewed quantitative evidence provides associations between stress, caused by recent life events, and injuries or mental health problems over a competitive season. From a stress-theoretical perspective, both, physical injuries and mental health problems, can be considered as an impact of life events on the biopsychosocial, developmental pathway. From a developmental perspective, injuries are perceived as life events that may impact performance or other levels of biopsychosocial development. The reviewed qualitative evidence elucidates coping strategies used by athletes and musicians in response to the occurrence of critical life events, and how different types of life events impact the biopsychosocial development of expert performers on multiple levels.

The findings of the analyzed, qualitative studies show that critical life events are not necessarily traumatic and/or hinder the developmental pathways of athletes and musicians. Performers, under appropriate circumstances, can certainly benefit from a wide variety of critical life events with regard to their development – often dependent on the coping strategies employed. Emotion-focused coping, problem-focused coping, and reflective activity often led to a favorable impact of life events on biopsychosocial development such as improved social relationships with significant others, superior performances, positive physiological and behavioral changes, and a wide range of psychological changes mainly related to adversarial growth. In contrast, when performers employed avoidance-focused coping strategies in response to life events, they often reported negative consequences for their subsequent physical and performance development such as inferior performances or injuries.

Our review also adds to recent domain-related reviews on talent development in sport psychology (e.g., Gledhill et al., 2017; Howells, Sarkar, & Fletcher, 2017). By employing a biopsychosocial perspective, we were able to draw a holistic picture of the role of life events in the developmental pathways of athletes and musicians. Additionally, by focusing on the concept of critical life events, which by definition includes both positive and negative events, we were able to identify a broad range of life events that had an impact on developmental pathways. This supplements the adversity-related experiences that Howells et al. (2017) identified in their review on adversarial growth in elite athletes.

In the following, we will discuss the thematic networks, offer applied implications, highlight key limitations of existing research, and provide a critical appraisal of our review.

4.1. Thematic networks: discussion of findings

Our three thematic networks present a thematic analysis of the main themes of the included studies with regard to our research question. Additionally, they also illustrate the chronological pattern from the onset of a life event-related experience, over the employed coping strategies, to the perceived impact of events on the biopsychosocial, developmental pathway.

Athletes and musicians encounter a wide variety of critical life events during their lives which all potentially influence their development on a biopsychosocial level. Health problems and events inside the performance domain were investigated most frequently in the included studies; events outside the performance domain were described less often. This unequal report of life events inside and outside the

performance domain could be related to the research context of most studies. When performers were approached as successful musicians or athletes in a performance-oriented environment, they may be less apt to talk about critical life events outside their respective field such as events in their private lives. However, when events outside the performance domain were reported (e.g. Aarresola et al., 2017; L.; Hardy et al., 2017; Howells & Fletcher, 2015; Morgan & Giacobbi, 2006; Sarkar et al., 2015; Tamminen et al., 2013) they were often traumatic such as experiencing abuse, the death of a family member or a close friend, or the divorce of parents. Consequently, performers perceived that these events had a major impact on their subsequent development and often resulted in adversarial growth on a psychological and personal level.

It is remarkable that we identified only five studies that examined the impact of critical life events on the developmental pathways of musicians; even though musicians are likely to experience life events that are similar to those of athletes and that potentially influence their performance development. Accordingly, the reviewed studies investigated far more athletes than musicians. However, the included studies consistently reported for both performance domains that being recognized as a talent ignited a desire to excel, which was considered essential for the future career. Both, musicians and athletes also identified health problems – mainly injuries – as critical life events. Often, expert performers attributed health problems to the high demands in high performance contexts. Although the concept of a *culture of risk* has only been used to describe the dominant culture of normalizing pain and injuries in elite sports (Nixon, 1993), the culture in music appears to be similar in this regard. When being faced with injuries, musicians and athletes attempted to conceal or ignore their pain. This avoidance-focused coping strategy also exemplifies this very culture of risk (Mayer et al., 2018; Nixon, 1993). Despite the cultural similarities of both performance domains, there are barely any studies that investigate both domains simultaneously. We could only find one study (Beltman et al., 2007) that examined critical life events in the careers of both athletes and musicians. Nevertheless, studies by the work group around Dave Collins and Áine MacNamara on relevant psychological skills in successful careers of top-level athletes and musicians show that the challenges of excellence development in the two areas are by all means comparable (MacNamara, Button, & Collins, 2010).

As critical life events differ in their nature and impact, so do people in their responses to an event (Schwarzer & Luszczynska, 2012). However, only one of the included studies attempted to investigate which psychosocial factors or personality traits may influence which coping strategies were adopted. When comparing adolescent and adult elite athletes with regard to the impact of critical life events on development, both groups reported very similar life events and consequences for the developmental pathway. When analyzing the described coping strategies in the original studies, reflective activity was only reported by adult elite athletes. However, due to the heterogeneous study designs and different methodological approaches, these findings should be considered with caution. Additionally, even though we depicted coping styles in four, thematically different categories, it is important to bear in mind that performers may employ more than one coping strategy simultaneously, or first use one strategy followed by another.

The idea of adversarial growth on a personal, psychological, and social level as a result of being confronted with negatively perceived life events was predominant in the data. Adversarial growth emerges through a process of struggling with adverse events. Individuals who experience adversarial growth typically report a higher level of functioning than prior to the event (Joseph & Linley, 2005; Linley & Joseph, 2004). According to a recent systematic review by Howells et al. (2017), the study of growth following adversity increasingly receives attention in athletic talent development research.

It is important, however, to take into account that most researchers rely on self-reports of adversarial growth, which could be illusory (Howells & Fletcher, 2016). In order to cope with traumatic events, individuals may actively search for benefits from the event as well as actively remind themselves of these perceived benefits (Tennen & Affleck, 2002). Adversarial growth may be illusory in cases where individuals construct hypothetical benefits or ignore a clear predominance of losses compared to benefits gained from traumatic events. In professional sports and music specifically, illusory growth experiences may arise from the above-mentioned pervasive culture of risk. This culture is characterized by the notion that pain, injury, and serious distress constitute a natural part of a career (Nixon, 1993) and that overcoming adversity characterizes highly successful performers. In other words, the culture of risk is clearly based on the assumption of "What does not kill you makes you stronger", and, as such, explicitly depicts adversity as a catalyst for positive change. Consequently, expert performers in music and sports may be especially prone to provide illusory growth reports.

4.2. Applied perspective

From an applied perspective, our findings stress that coping strategies for dealing with critical life events play a central role in successful developmental pathways. For practitioners, coaches, teachers, and mentors it might be relevant to teach performers effective coping strategies early to prepare them for critical life events that are likely to occur. In this regard, social support could be an essential strategy. In the analyzed quantitative studies, social support seemed to moderate the relationship between life-event-related stress and injuries or mental health problems. Similar findings emerged from the analyzed qualitative studies: Here, performers emphasized the importance of social support in the process of coping with negative life events. Seeking support for emotional and instrumental reasons was identified as a frequently employed coping strategy, which often had a positive impact on the developmental pathway. This finding stresses the importance of professional emotional support (i.e., counselling); a field that is to some extent established in professional sports, but is still in its infancy in professional music, despite its large potential. From an applied perspective, we recommend that coaches, music teachers, and mentors encourage their athletes or music students to enlarge and deepen their social networks, to use these networks when challenges arise, or to ask for professional emotional support.

Our analysis also suggests that overcoming critical challenges in a career might be essential for the perfection of skills. We do not want to imply that negative life events are a prerequisite for achieving excellence. However, against the background of our findings, practitioners should consider to systematically use the benefits of challenges. Such challenges should be explicitly career-related, manageable, and focused on the refinement of skills. Challenges such as playing on a different position, moving up to the next age group etc. can be systematically employed to create appropriate conditions for deliberate practice, develop coping strategies, and foster durability.

4.3. Limitations of current research

Clarity of definitions. In sum, most studies did not offer clear definitions of the terms critical life event, life experience, or related terminology. Hence, we tried to offer clear definitions in our theoretical background based on theoretical and empirical work on critical life events in other fields. In addition to definitional and terminological issues, it was apparent that authors rarely referred to specific developmental theories when examining life experiences or critical life events.

Theoretical approaches and research designs. Overall, we identified theoretical shortcomings in the reviewed studies. Most studies were not thoroughly grounded in a specific theoretical framework, which evidently influenced the methodology and lowered the quality of the results. Even though the included studies were not explicitly based

on specific developmental theories, they can be implicitly attributed to the two common theoretical perspectives on life events that we described in our theoretical background.

Ten of the reviewed studies implicitly employed a stress-theoretical perspective on life events, nine of which being of prospective, quantitative design, and one qualitative. These studies examined the influence of life-event-related stress on pathological phenomena, such as injuries, CMD (depression, anxiety, sleep disturbances) and burnout in athletes. Methodologically, reviewed stress-theoretical studies applied a variety of different life-event scales. Most of these scales use subjective severity-ratings for each event to assess the subjective significance that might differ from person to person. These severity-ratings of the checked items are then summed up to yield a total score that indicates how much life-event-related stress individuals experienced. The same score can then refer to completely different life events. Consequently, it is questionable whether different life events should be regarded as psychologically equally demanding and be subsumed in the same analysis.

The remaining studies ($n = 26$) can be implicitly associated with a developmental perspective on life events, which construes critical life events as natural interventions in the life course (Filipp, 1995). The respective studies were interview-based, with a focus on the subjective nature of experiences. Further, we observed that researchers either predetermined one specific life event and investigated the appraisal of the event and the coping process or examined psychosocial factors that performers subjectively considered relevant for their career trajectories. Regarding our central question, the limitation of the first approach is that it does not take into account whether performers perceived the event as significant for their development. The second approach, on the other hand, describes a wide range of psychosocial factors as important for their career development, with life events just being one among many factors. This makes it very difficult to exactly assess the impact of critical life events on the developmental pathways of gifted individuals.

5. Conclusion

To conclude, some important limitations of our review need to be considered. A first limitation of this review lies in the categorization of the reviewed studies into three thematic networks. This categorization may possibly mask the complexities inherent in experiences. For example, the grouping of findings into one category, such as adversarial growth, might obscure the interactional and multilayered complexities that are characteristic of the impact of life events on the developmental pathways of athletes and musicians. However, the analyzed studies were, if at all, based on theoretical frameworks that do not allow an in-depth understanding of such complexities within a developmental pathway. Secondly, when making applied recommendations, we do caution that these are based on predominantly retrospective evidence with a moderate risk of bias. Another limitation is the limited number of analyzed studies conducted with musicians, even though the findings of music-related studies (all being of qualitative design) align closely with the sports-related studies. Additionally, data may be incomplete because some studies might have been published in another language or published in journals that are not indexed in the databases used. However, through cross-referencing and additional searches in GoogleScholar, we aimed to lower the risk of bias across studies.

In summary, it proved to be extremely difficult to conduct a systematic review on the impact of critical life events on the developmental pathways of expert performers. Overall, the topic is not researched systematically, which becomes evident in the wide range of methodological concepts, methods, and focus points of studies. Even though encountered life events, coping responses, and subsequent consequences may differ by gender (Costello, Bieuzen, & Bleakley, 2014; Ristolainen et al., 2012) and developmental stage, it was not possible to conduct subgroup analyses for gender and developmental stage due to heterogeneous study designs, sample characteristics, and methodological approaches. Additionally, the included studies did not report their findings separately for men and women or athletes and musicians at different developmental stages. There might be gender differences especially when considering that career-related research in other performance domains reports about these, especially in relation to career advancement and career patterns (Biemann, Zacher, & Feldman, 2012; Timberlake, 2005). Therefore, for future research in the area of talent development in sports and music, it would be important to analyze gender differences and report them in particular.

Notwithstanding the above, our systematic review provides original contributions to the body of research by highlighting research trends and providing a detailed methodological appraisal of included studies. By thematically synthesizing findings from qualitative and quantitative studies, we offered a rich and practical understanding of the impact of critical life events on the biopsychosocial development of athletes and musicians. Our findings also support a broad conceptualization of giftedness, underscoring the idea that critical life events impact the dynamic pathway to excellence in different achievement domains. Taken together, we hope that this review and synthesis will further improve talent development practices.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.psychsport.2019.101565.

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5.5 Article 4: "Athlete Health Protection: Why qualitative research matters"

Bekker, S., Bolling, C., Ahmed, O., Badenhorst, M., Carmichael, J., Fagher, K., Hägglund, M., Jacobsson, J., John, J., Litzy, K., Mann, R., McKay, C., Mumford, S., Tabben, M., Thiel, A., Timpka, T., Thurston, J., Truong, L., Spörri, J., van Nassau, F., Verhagen, E. (2020). Athlete Health Protection: Why qualitative research matters. *Journal of Science and Medicine in Sport,* 23 (10), 898-901. https://doi.org/10.1016/j.jsams.2020.06.020

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Editorial

Athlete health protection: Why qualitative research matters

The past 30 years of athlete health protection – namely, injury and illness prevention and management - has largely been successful in answering the research questions that our field has, up until now, sought to investigate. Interventions have proven efficacious in a wide range of areas and populations, and the field has moved to optimise effectiveness in recent years. Despite this success, it is widely acknowledged that athlete health protection still has several challenges to address.

These challenges include bridging the gap between research and practice in a number of key ways, including for example: the inclusion of the athlete voice, and the implementation of health protection strategies. In response to these challenges, recognition of the complexity of athlete health protection has recently emerged and qualitative research methods have been advocated as one important approach that can provide new understandings and lead to better practical outcomes.[1,2,3] This is because qualitative research provides insight into athlete and other stakeholder perspectives, can improve clinical and implementation understanding and outcomes, and may help us to consider the athlete experience in our health protection work. There is, in this way, a real need for research that complements existing approaches and connects researchers from different disciplines, and which also distinctly holds space for the unique insights that qualitative approaches can add to current knowledge. In this way, qualitative research can explore and incorporate dimensions that are not currently represented in the literature, for better and more influential outcomes.

In September 2019, we founded the Qualitative Research in Sports Medicine (QRSMed) special interest group. Our aim is to identify and champion strategies required to facilitate, support, and incentivise qualitative research in athlete health protection. The purpose of this editorial is, as a first step, to highlight *why* qualitative research matters to athlete health protection.

1. Qualitative research in athlete health protection: key examples

Encouragingly, high-quality and clinically/methodologically-relevant examples of qualitative research are emerging in our field. These have revealed new, innovative, and helpful findings related to athlete health protection. Whilst we recognise the importance of quantitative approaches as being fundamental to some research and practice questions, we also advocate that other decisions are more usefully informed by qualitative (and mixed-method) approaches. To show this, we highlight qualitative exemplars from the work of QRSMed members around magnifying the athlete voice, exploring the circumstances under which elite athletes may hide their pain, and uncovering the complexity of preventing and managing injuries. Finally, we reflect on what the implications might be for the research-to-practice gap.

If we truly believe that the *athlete* is in fact the main focus of athlete health protection, it stands to reason that their experiences and perceptions should shape and inform the way we develop our athlete health protection strategies. Information about their beliefs, perceptions, behaviour, preferences, and experiences can and do shape and improve healthcare decisions after all.[4] Badenhorst and colleagues[5,6] reported on the experiences of South African rugby players who sustained spinal cord injuries on the field. The players in this study described the symptoms they experienced and how they tried to make sense of what was happening and importantly, how they verbalised what they were feeling to fellow team-mates or coaches. For example, several players experienced proprioceptive disturbances, but did not understand what was happening to their bodies. Many players had never considered a spinal cord injury to be a possibility while playing rugby, nor what they would experience if it happened. Players described the factors they considered to contribute to their injury, including descriptions of foul play, which included illegal tackles (both by themselves and others) and unsanctioned aggression with the intention to harm. For some participants, the pressure to perform meant winning at any cost, leading to increased risk-taking behaviour. This research showed that it is important for fellow team-mates, coaches and referees to be aware of the signs and symptoms of spinal cord injury, as - especially in amateur games and communities that have fewer resources and less medical support (which is often the case in South Africa) - they are often the first to respond to an injured player.

Uncovering these complex layers of behaviour is key when considering preventative strategies.[7] Optimal injury management may be influenced by various factors present at the time of injury and these factors need to be understood in their respective contexts.[8] 'Context', in this sense, often plays a determining role in the way the injury management process unfolds. This is mirrored in work from Fagher and colleagues,[9] who showed through qualitative research that the perception of injuries and possibilities to prevent them may vary between and across athlete populations. In their research, Paralympic athletesperceptions and experiences of injury prevention differed significantly from their able bodied peers due to the already existing impairment. Consequently, these qualitative findings assisted researchers in specifically tailoring injury prevention

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programmes that are underpinned by the athletesówn perceptions and possibilities.[9] Similarly, the experiences of players reported in the spinal cord injury study discussed above have been utilised by BokSmart,[10] South Africa's national rugby safety programme, in their mandatory biennial courses to educate coaches and referees in the early recognition of these injuries. In this way, qualitative research in athlete health protection is already proving impactful in athlete health protection policy and practice.

A second example of qualitative research leading to differentiated insights is in the exploration of the circumstances under which elite athletes may hide their pain and injuries, and what the implications might be for practice. Qualitative research here shows that elite athletes tend to ignore new physical complaints or delay seeking care until it is too late. They also tend to return to training and competition too early after recovery.[11] Concealing pain in order to participate in competitions has been shown to be very common in elite sports,[12–14] and one of the main reasons for this risky behavior is the so-called 'culture of risk' in these settings.[15]

To analyse the culture of risk by applying qualitative approaches thus seems particularly appropriate. The typical elite sports culture is characterised by a collective tacit understanding that training and competing in pain is an expected part of elite sports.[13] At the same time, athletes perceive the willingness to return to competitions after injuries and illnesses as early as possible as a precondition for success.[11] This research showed that some athletes are completely aware of the health risks that go along with competing while being hurt, and are willing to accept the consequences. Yet that others may not reflect upon the harmful nature of this behavior. The research and practice questions related to this problem thus require a highly sensitive and investigative approach for gathering information about athlete perceptions and behaviors directly. In this way, qualitative approaches are useful in assisting and identifying the dynamics of being socialised into the culture of risk.[16,17] In this way, qualitative approaches are useful in capturing details about sensitive topics, hidden emotions, and confusing bodily experiences during such biopsychosocial transitions.[18]

Qualitative research thus makes it possible to reveal harmful interaction patterns between athletes on the one hand, and trainers, clinicians and the broader sociocultural context of sport on the other.[19] For example, athletes are expected to cope with stressors without mentioning any complaints. As the performance level increases, the more athletes are expected to show stoic invulnerability and 'steeliness'. Ignoring and trivialising pain becomes a standard behaviour, and athletes learn to inhibit their pain perception.[20] This pain inhibition works because young athletes often transfer the control of their individual well-being onto the coach.[21] Athletes accept that the coach decides whether training loads or pain are too much for competition or training. Since the coaches perceive themselves as to be guided by objective 'load standards', and assume that they know the athletes and their complaints, they tend to underestimate the athletes' willingness to ignore and conceal pain and injuries.[18] Consequently, training load and the actual resilience of the young athletes do not necessarily coincide. Similar patterns are observable regarding the medical care provided in elite sports. Medical care itself may not recognise or address the acceptance of the highly risky willingness to 'compete hurt'.[21] In the case of pain and injury, athletes expect their medical staff to prioritise fitness for training or the next competition. Actions of medical staff are therefore often characterised by the logic of "repairing "instead of healing. In the case of pain and injury, medical staff then often prioritise a "quick fix" instead of healing, not infrequently due to real or perceived pressure. In this sense, ethical dilemmas and power struggles characterise interactions in the context of the treatment of injuries and pain.[22,23] However, ethical dilemmas and power struggles are not easily quantified. Rather, what is needed is qualitative research that makes it possible to 'drill below the surface' to a more nuanced understanding of these complex interactions.

A key example of where qualitative research may provide important additional information is the implementation stage of health protection strategies and guidelines, and in particular the question "are contemporary findings and clinical recommendations reaching the target audience, the athletes themselves?"

In a recent work on sports-related concussion (SRC), despite an evolving body of literature and scientific consensus on the topic, ski racers' understanding of SRC and its management revealed to be strongly limited.[24] Major shortfalls were related to: 1) athletes' grasp of the precise definition of SRC, 2) athletes' awareness of the connection between SRC and affective symptoms, and 3) athletes' understanding of the reasoning behind graduated return-to-play protocols. These three gaps may lead to the under-reporting of symptoms and premature return-to-play following SRC. These findings, derived from qualitative research, have clear implications for the implementation of athlete health protection measures.

Similarly, a recent qualitative study examined champion runners' strategies to stay well and sustain their performance.[25] It was found that these excelling athletes were characterized by their constant attention to symptoms of ill health and not letting environmental strain interfere with adjustment of sports load. Many top-level runners originate from global regions where formal education programs and health insurance plans are poorly regulated and supported, and this qualitative research showed that bio-psychosocial models including empowerment at *individual and systems levels* should be considered when health and preventive services are planned for professional runners. As Greenhalgh and colleagues[26 [pi563]] write: "Qualitative studies help us understand why promising clinical interventions do not always work in the real world, how patients experience care and the surrounding world, and how practitioners think." Further, qualitative research can help us better understand the complex relations within athlete health protection as a complex system, including the socio-ecological context in which athletes seek and receive care, and how best to influence those involved in athlete health protection for better and more effective outcomes.

These examples show that, by applying qualitative methods, we can gain an in-depth understanding of different contexts, and learn from insights that may shape future interventions.[8] In this way, qualitative research can assist all stakeholders (including athletes, governing bodies, coaches, and clinicians), to be more responsive to the needs of athletes themselves, thereby putting sports in a better position to provide optimal care resulting in better protection against injury and illness.[5] By examining the complexities of athlete perceptions and experience, qualitative methods may offer substantive improvements to a one-size fits all approach for athlete health protection.

2. A call to action: more and better qualitative research

With the turn towards the importance of centering the athlete as key stakeholder - and their inclusion in research and practice decisions – qualitative research has never been more relevant or timely. Qualitative research has the inbuilt mandate to place the stakeholder (often the athlete themself) front and center in both formulating the research question as well as the analysis. Truly athlete-centred approaches, as we have shown in our exemplars, will require that we embrace and incorporate the 'multiple truths' and 'social facts' of our research and practice.[27] This includes recognising and integrating the perspectives of athletes, members of their multidisciplinary coaching, and clinical care teams, and others involved in athlete health protection.[8] In this way, athlete health protection is now confronted with different kinds of questions that

require methodological pluralism and pluralist perspectives – with a specific focus on high-quality qualitative research - for better and more relevant outcomes.[2]

By ensuring a seat at the table for qualitative research, we hold space for more clinically-relevant knowledge building, the advancement of excellence in our field, and, ultimately, ensuring that we truly are working in service of athlete-centred research and practice. In this way, qualitative research is highly important to, valuable for, and relevant to, the big picture of athlete health protection. The time for high quality qualitative work has come, and as the *Qualitative Research in Sports Medicine* special interest group, we are eager to lead the way.

Conflict of interests

The authors have nothing to declare.

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5.6 Article 5: "Qualitative interviews in sport and physical activity research – do not forget the body"

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Qualitative interviews in sport and physical activity research – do not forget the body

Narrative Interviews are considered as the methodological gold standard when it comes to researching complex phenomena associated with embodiment (Dowling & Garrett, 2016), critical life events or illness experiences (e.g. Charmaz, 1993; Frank, 1995). Interviewing people 'is a way of writing the world, a way of bringing the world into play' (Denzin, 2001, 25). Interviews can uncover unorthodox stories instead of central tendencies (Josselson, Lieblich, & McAdams, 2007, 8), create meaning through the shaping or ordering of experiences (Chase, 2005) and – not least – bring insights into the social, cultural and historical development of biographies (Chase, 2005). However, interview data usually 'consists of verbatim quotations and sufficient context to be interpretable' (Patton, 2002, 4). Hence, the scientific benefit of a narrative interview depends to a large extent on the interviewee's linguistic skills, more precisely, on his/her ability to verbalise experiences, feelings, or physical sensations.

'Bodilessness' as a limitation of narrative interviews

The limitations of narrative interviews in the exploration of emotions and physical sensations have been extensively described (Orr & Phoenix, 2015; Tarr & Thomas, 2011). In our own research on sport- and activity-related biographies, we have regularly noticed that paying attention only to the verbal expressions does not live up to the purpose of the interview, namely to get 'in-depth responses about people's experiences, perceptions, opinions, feelings, and knowledge' (Patton, 2002, 4). Only to record the spoken word alone often does not do justice to the interview situation that is also characterised by body postures, gestures, and mimics that continuously change dependent on the content of the narration. To us, this became most obvious in a (still ongoing) study with professional actors and dancers. For actors and dancers, body language is a central means of performance. Professional education in these areas consequently consists, to a relevant extent, of learning to talk with the body. In our interviews, actors and dancers used their bodies in a very expressive manner to enunciate success, disappointment, pain and joy, while talking about the ups and downs of their professional careers. Here, the limitations of spoken language became particularly apparent. Indeed, it was eventually – in a Wacquantian sense – the interviewees' 'body talk', their mannerisms and habits that expressed the incorporation of social structure in the most explicit way.

The qualitative interview as a biopsychosocial phenomenon

If we understand an interview as a field of social interaction between at least two individuals, we have to be aware that, within this interaction, meaning is exchanged and constructed not only through the use of talk, but also through expressions of the body. While talking, the display of postural orientation toward the other individual establishes the interactive ground that frames the situation. Social interaction is therefore not physically static but the body is dynamic and temporally unfolding, displaying a reflexive stance toward the other individual and carrying propositional information through gestures and facial expressions (Goodwin, 2000). Merlau-Ponty (1945) stated that the body is both subject and object, that we not only have a body but that we are the body. The body is a constituting part of individual experience. Body and world are interconnected. The body actively anchors us in the world (Merleau-Ponty, 1945). Experience, therefore, necessarily involves the body and the construction of the self arises from such experiences (Van Wolputte, 2004). In this sense, the body represents the 'material infrastructure' of the production of selves, belonging, and identities (Turner, 1994). Through sensorimotor coupling with the environment, living beings gain access to the environment, make sense of it, are shaped by it, and reciprocally change it themselves (Thompson, 2007).

Methodological consequences

The analysis of bodily expressions as a part of a qualitative interview should, therefore, not be neglected if we want to fully understand human perception, thinking and acting on one hand and distinction and integration into a social field on the other hand (cf. Bourdieu, 1979, 1980). Hence, interviewees have to be understood as naturally embodied beings who experience both the self and the world in and through the body. However, while the bodily practices are a typical research object of systematic observational studies (cf. Giardina & Donnelly, 2018), relatively little attention has been paid to bodily expressions as a source of information in narrative interviews. A review by Denham and Onwuegbuzie (2013) found that only about a quarter of qualitative research papers in the journal *The Qualitative Report* included any form of non-verbal communication data. Even more, the way non-verbal data was included, differed from mentioning the body only to a more 'substantial use wherein researchers provided justifications (e.g. purpose of collection of nonverbal data), methods of integration (e.g. ways to merge transcripts and observation data), and interpretative connections (e.g. complementary value of nonverbal communication)' (Denham and Onwuegbuzie 2013, 682).

Denham and Onwuegbuzie state that ‘the non-use of nonverbal communication data in qualitative research studies and the qualitative phase(s) of mixed research studies, for the most part, represents an important error of omission’ (Denham and Onwuegbuzie 2013, 690). This also appears to be true even in qualitative interview studies within the field of sport and physical activity, where the body plays an essential role. This does not mean that the body has not been analysed as an experiencing agent. In contrast, in many studies, particularly in those who deal with the experience of illness and pain in sport, the analysis of the body plays a central role (e.g. Cole, 2000). Data, however, is mostly obtained through verbal narrations, while relatively little attention has been paid to gestures of the body when the interviewees were talking about these experiences.

Focussing on verbal language only might be considered a methodological limitation in all areas, where bodily experiences are particularly difficult to verbally articulate. This is certainly the case in the pre-objective world of pain and suffering, but also when it comes to the study of cultural embeddedness, as embodiment is the existential ‘condition of possibility’ (Kant) to express cultural belonging. From a phenomenological standpoint, the implicit conceptual duality of narrative interviews has to be resolved, particularly when it comes to the analysis of life stories. We argue that it is important to pay attention to multiple semiotic resources used by study participants when aiming to gain access to what is going on in people’s heads while they reflect on the significance of personal experiences for their life trajectories. Verbal talk itself certainly contains multiple sign systems, and the analysis of verbal language is and will be the central means to gain access to individual sense-making processes. However, the use of the body to express sense in a pre-reflexive way is an intrinsic part of our being-in-the world. To understand lived experience therefore requires to not only abstractly understand the embodiment of social structures but also the way how embodiment is non-verbally communicated. And as long as the body plays a vital role in transporting meaning, the standard procedure in narrative inquiry, namely solely focussing on verbalised thought processes, carries the risk that the data only reveal parts of the whole picture.

The recording of body talk as a methodological challenge

Even if the researcher is aware that in narrative interviews not everything is communicated via verbal language, the question remains how body talk can be recorded. Tarr & Thomas (2011), who analysed the pain and injury stories of dancers, overcame the limitations of narrative interviews by performing so-called body mappings. Since pain is a subjective

phenomenon that is very difficult to put into words, they took three-dimensional scans of the dancers' bodies and asked them to express the (embodied sensations) graphically by mapping current and past pain, injury locations, and bodily strengths and weaknesses onto the visual representations of their body.

This innovative method is a very beneficial addition to the verbal interview. It probably could also be applied to the illustration of verbal descriptions of body sensations during an interview. The recording of the 'natural' body talk that unconsciously accompanies spoken statements, however, has certainly be a more integral part of the interview situation. Due to the fact that the interviewer normally does not have time and attention to note down an interviewee's body language while conducting the interview, body language has to be either video-recorded (ideally from different positions) or a second researcher has to be present and keep records of the body talk. Beyond the question of how to record body talk, we also need to consider how to analyse the recorded body talk to grasp the richness of such qualitative data. A special issue of the *Forum: Qualitative Social Research*, edited by Knoblauch, Baer, Laurier, Petschke, & Schnettler, (2008), gives an overview of what methods of visual analysis could be applied and how they could be combined with 'traditional' qualitative methods.

Analyzing body talk might indeed help to achieve a more detailed description of the interviewee, his/her personality, emotions and interpersonal attitudes in situ. And it might give additional information on synchronic and asynchronic aspects of an interviewee's storytelling. The analysis of the body talk, however, will make qualitative research even more resource consuming than it has already been. At the same time, in such body-fixated social areas as sport and physical activity it might be worth the effort. After all, the discovery of the body as a research topic in sociology, the so called 'corporeal turn' (Giardina & Donnelly, 2018; cf. Alkemeyer, Brümmer, Kodalle, & Pille, 2009; Crossley 1995a, 1995b; Gugutzer 2006; Shilling 2007; Turner 2008), has already paved the way.

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5.7 Article 6: "bioMAP - Development of a software for the retrospective analysis of biopsychosocial health trajectories in elite sport"

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bioMAP - Development of a software for the retrospective analysis of biopsychosocial health trajectories in elite sport

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1 Introduction and Objectives

The highly individualized management and control of training processes poses a significant challenge for coaches, particularly in team sports. Existing approaches for the management and control of training processes in elite sports have mostly been medically or technologically oriented. However, only a few instruments are available for specifically recording health trajectories and developmental processes.
Results of the WVL project "Individual Health Management in Young Competitive Sports (GOAL)" (Thiel et al., 2011) suggest that health-related developmental processes as well as the athletes' individual life worlds have a considerable influence on their performance development. The inclusion of these aspects into the training process represents a particular problem for coaches at the elite level, since they interact with their athletes only during a limited amount of time. In combination with the variety of tasks and limited time resources, coaches barely have the opportunity to take the athletes' life circumstances and their development with regard to health and personality into account when managing their training and performance development. The aim of the service project therefore was to develop an analytical instrument that would enable an intra- and inter-individual comparison of biopsychosocial health trajectories of young athletes while taking their lifeworld into account. The objective was to verbally and visually examine the biographical development of biopsychosocial health indicators depicted in a coordinate system by means of different curve courses. The analysis tool should be developed in the form of a software program for a tablet computer, which would allow the recording but also the immediate analysis and interpretation of the data.
As a basis for the software program, we used the biographical mapping approach, which was originally developed in the BISp-funded project "Gesundheit im Spitzensport [Health in elite sport]" (Mayer, 2010; Thiel, Mayer & Digel, 2010) and refined in the GOAL project (Thiel et al., 2011). This method was used very successfully in the GOAL project to monitor growth-related and overload-related disorders in young competitive athletes. The method also showed potential for the monitoring of athletes' health because it is often quite difficult for athletes to verbalize sensitive topics such as painful experiences and stigmatizing conditions due to the elite sports *culture of risk*, which is characterized by the concealment and trivialization of pain and injuries (Schubring & Thiel, 2014). The biographical approach makes it possible to identify health-related crises of athletes in a differentiated manner. These crises often result from complex interrelations between social conditions and critical life events over a longer period of time and mostly follow chaotic structures (Frank, 1995). With regard to the recording of biographically significant health indicators, we

were guided by the biopsychosocial health model and its transfer to the field of youth sports (Thiel, Schubring, Schneider, Zipfel & Mayer, 2015).
The following biographical mapping (Fig. 1) from the GOAL project illustrates the chosen approach of visualizing biographically significant developmental processes.

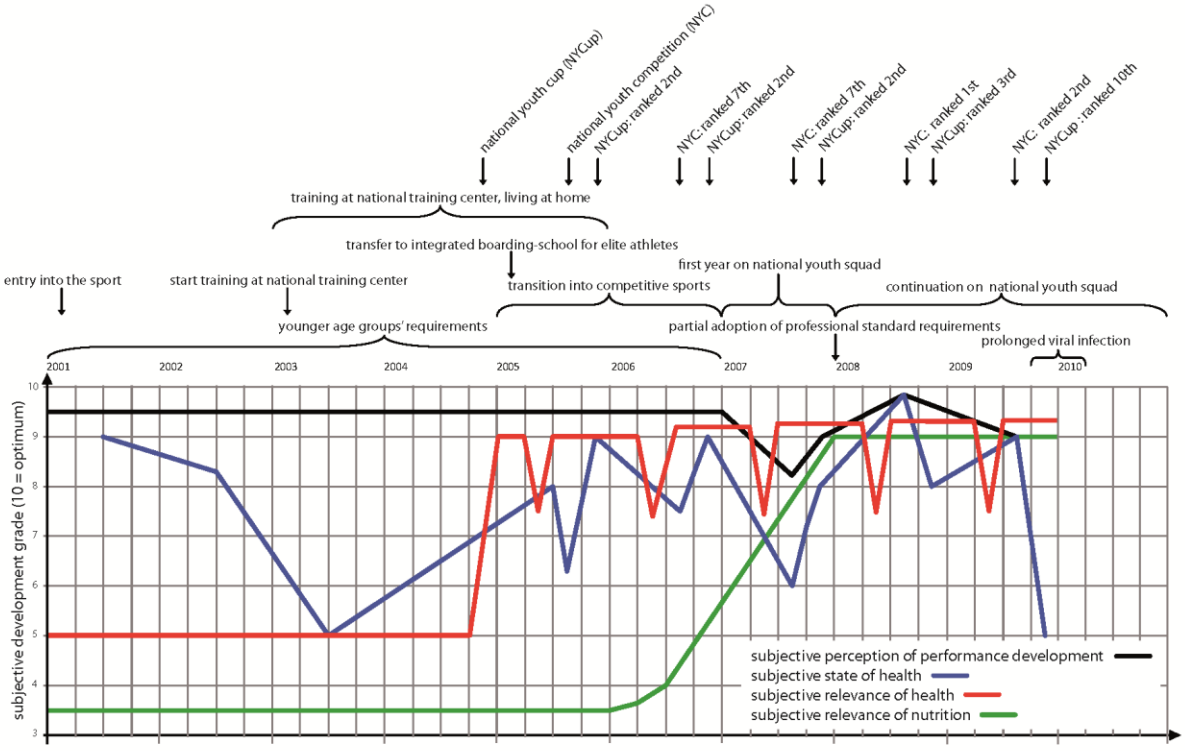

Figure 1: Exemplary biographical mapping (Thiel, Schubring, Schneider, Zipfel & Mayer, 2015)

Until the service project, the procedure had served as a scientific assessment tool but, due to the time and organizational effort involved, it was hardly suitable for transfer into the practice of elite sports. Up to the described service project, the athlete had to draw the curves and context information by hand into a pre-printed coordinate system. Afterwards, all the information had to be digitalized and processed with a graphic program. The development of an appropriate software tool for the simple recording, presentation, and analysis of biopsychosocial health indicators was therefore a central prerequisite for the transfer into the practice of elite sports. The primary goal of the project was to develop a software-based tool for coaches that would enable them to manage and control their training practices based on the athletes' subjective experiences.

For coaches, the development of such a software is of great value because it allows them to familiarize themselves quickly and yet in detail with biographically significant health-related developmental processes of their athletes in order to initiate interventions at an early stage (e.g. training adaptations, involvement of health experts etc.). In this way

- processes of overloading and distress can be recorded at an early stage,
- critical moments can be identified in athletes' biographies, and
- relations between athletic performance and biopsychosocial health indicators can be identified.

This is particularly relevant for coaches of teams with frequently changing players.

Our own preliminary work on the biographical system mapping method (see above) was the basis for the development of the software for the analysis of health-relevant developmental processes. The following basic functions had to be translated into the software for the digital assessment of these biographical trajectories:

In order to generate an individualized time axis, central orientation points of the athlete's biography (e.g. age, nomination for the national team, change of club, change of school, athletic successes etc.) must first be recorded and displayed on the x-axis. Using this individualized coordinate system, the athletes then reconstruct, for example, the course of their subjectively experienced state of health, athletic performance capability, or biographically relevant injury and illness courses. The athletes draw these respective curves into the coordinate system via the touch screen. The y-axis represents an intensity-scale ranging from 0 -10 with larger values representing a more pronounced expression of the respective variable, e.g. of the subjective state of health. The curves are recorded one after the other, and the previously drawn curves do not remain visible in the coordinate system to reduce reciprocal influences. The x-axis remains the same throughout the interview and can be used for orientation purposes, but can be supplemented with other important life events if required. After all curves have been drawn and recorded electronically, it should be possible to compare selected curves with each other for analysis purposes. The software should allow to transfer the data to Excel and thus also to the SPSS statistics program, so that statistical analyses can also be conducted (especially for larger samples or for the analysis of curve courses). The primary goal of the service project therefore was to develop a functional software for the analysis of biographical developmental processes. This software should fulfill the everyday demands of elite sports with regard to design, handling, and content.

2 Documentation of the Project Phases for Software Development

In general, the methodological approach of the service project was based on the central phases and milestones of software development (cf. Grechening, Bernhart, Breiteneder & Kappel, 2010). Beside development workshops with selected experts from elite sports, extensive alpha and beta tests were conducted with coaches and athletes. This ensured that the software design was guided by the specific requirements of elite sports. Thus, aspects of user-friendliness were taken into account in the development of the end product right from the start of the project.

The implementation of the project was divided into the following three phases:

1. Analysis and definition of requirements
2. Conception and development of the alpha and beta version
3. Test, documentation, and implementation of the Release Candidate

These project phases were regularly documented and evaluated as part of the service project and are described in detail below.

2.1 Collaboration Partners

The German Volleyball Association acted as the overarching collaboration partner for the project. The software development was carried out with the Bundesstützpunkt Nachwuchs Volleyball [German federal youth training base] of the VC Olympia Berlin. As a volleyball club with an affiliated boarding school, which houses the best German volleyball and beach volleyball talents in Berlin and thus pursues a sustainable talent development concept, it was possible to win a collaborator who allowed us to carry out the development of the software in an absolutely elite sports-oriented context. Through already existing good contacts with the manager of the Bundesstützpunkt Nachwuchs [German federal youth training base], Jörg Papenheim, we were able to involve experts (coaches and young athletes) during the development of the software. This made it possible to conduct a detailed field test of the beta version with young German volleyball talents and thus test the usability of the software in practice.

2.2 Project Phase 1 - Analysis and Definition of Requirements

2.2.1 Project Start and Detailed Planning

As a first step, an IT specialist advised us on the technical possibilities and limits of software programming. Additionally, we interviewed Jörg Papenheim (manager of the VCO Berlin) about the initial expectations from sports practice as well as ideas for the content of the curve courses. From this first collection, we derived the following variables:

- Subjective health/subjective complaints (including growth problems)
- Development of burnout
- Compatibility between school and elite sports
- Eating disorder
- Performance development (including aspiration for success)
- Adaptation to the training group (coping with status passages)
- Pressure to perform
- Overtraining
- Recovery (mental/physical)

These very general initial health dimensions were further concretized over the course of the three project phases and implemented into the bioMAP software. In addition to this collection of ideas about potentially relevant health indicators, we developed the following research questions, which guided the design of the content of the software:

- How stressful are the major competitions in a season for the athletes and how stressful is the preparation for those?
- What influences the selection for the starting team and how is this selection process experienced by the athletes themselves?
- How much pressure do athletes experience from competing against others?
- How do athletes react to their coaches?
- How much pressure do coaches put on their athletes?
- Observing the development of an eating disorder (with additional use of the Questionnaire from Paul & Thiel)

- What role does the coach play in this regard, what role do the parents play (from the subjective perspective of the athlete)?
- How do the athletes themselves perceive their weight?

Additionally, we identified the following points as limits or difficulties that had to be taken into account during the development the software and the actual interviews and analyses:

- Anonymity
- Social desirability
- Technical difficulties
- Practicability → Required time, spatial conditions

Based on this first collection of ideas, the first expert workshop in Berlin was prepared.

2.2.2 Preparation and Organization of Expert Workshop I

For the first project workshop, we wanted to give a presentation focused on the content of the software. Here, we aimed to focus on the relevance and necessity of the software and present a 'pre-alpha version' to illustrate the basic principles of the biographical mapping approach and demonstrate the difference between a pencil-paper version and a digital one. In close consultation with our programmer, we developed a first 'raw version' of the software, which already included the following basic functions:

- Creation of a personal profile (including basic personal data)
- Entry of biographically relevant events into the coordinate system
- Drawing of health-related curves into the coordinate system
- Selection and comparison of several curves

2.2.3 Implementation and Evaluation of Expert Workshop I

The first expert workshop on September the 15th, 2016 at the German federal youth training base in Berlin had the aim to present the project and to work out the practical requirements for the assessment tool. In order to integrate the expectations of elite sports into the development process right from the start, the workshop was attended by manager Jörg Papenheim and the branch manager, two junior national coaches, one athletic trainer, and three athletes (2 females, 1 male). The content presentation was strongly focused on the background and the advantages of the biographical mapping approach. During the workshop, all workshop participants were asked to draw their own biographical mapping on paper. A rudimentary version of the bioMAP software was also presented to illustrate the advantages of a digital assessment tool.

The practical requirements and expectations from the perspective of elite sports were then developed in small groups (coaches and athletes separated) and then in a discussion with all participants. The discussions were led by the following questions:

1 Which health-related developmental processes are of interest?

2. What are the expectations regarding the usability of the software?
3. What are the difficulties/problems/limitations/open questions regarding the software?

The following results were collected, especially from the perspective of coaches and athletes (see Tab. 1 and 2).

Table 1: Results from the coaches' perspective (Workshop I)

Relevant data on health-related developmental processes	Expectations with regard to usability	Difficulties/limits/open questions
- Well-being in relation to load (objective and subjective) - General curve for physical complaints and injuries (not focused on singular illnesses or injuries) - Pressure from expectations in school (stress in school) - Curves on motivation (sport, school, nutrition → has to be differentiated) - Private life (relationships, living conditions) - Diet (factual and processual knowledge, knowledge and putting it into practice) - Time for recovery - Personality characteristics to support individualists, who want to take responsibility and are willing to risk something	- Software should work on all mobile devices - Fast tracking of curves has to be possible if used in training sessions (max. 10 minutes) - Flexible switching between different input masks should be possible	- Time points of data collection (weekly, monthly, etc.) - How will results be transferred to practice? What new information does the data generate? Background: Coaches are aware of (social) factors, but are unable to influence those because the relevant structures (school load) are outside of their control - Limits of the bioMap are discussed against the background of experiences with an already existing training load monitoring app, that is used directly after the training session. Problem: requires effort, athletes do not really participate, have to be forced, added value does not justify the effort required - Idea of athletes to design the app as a diary for athletes is discussed by the coaches. Athletes could use it independently on their own devices at selected time points. The coaches receive this information regularly. This helps athletes to self-reflect and coaches would get an insight into this (with relatively limited time efforts).

Over the course of the event, we recognized that the term 'app' is associated with a very specific understanding of software among athletes; namely that of a program for use on their own smartphone or tablet, which is 'fed' with data at regular intervals. During the small group discussion, the athletes therefore independently developed the

idea of a kind of 'athlete's diary', This idea extended the original idea of developing an assessment tool for coaches.

Table 2: Results from the athletes' perspective (Workshop I)

Relevant data on health-related developmental processes	Expectations with regard to usability	Difficulties/limits/open questions
- Clear distinction between sport and private life. Each area should be assessed with a different curve, also to illustrate the personal relevance of private life and sport. - Curve on stress - Performance pressure (School, vocational training or studies separated from sport) - Performance development (subjectively perceived by athlete him- or herself and 'objectively' perceived by the coach, also with regard to performance at school) - Difficulty of organizing daily life (commuting, boarding school vs. living with parents) - Time effort required for school, training, leisure time (over a whole season to see differences between preparation period, training camps, national team, holidays etc.)	- App has to look modern and appealing otherwise it will not be stimulating - Flexible data collection - Should be possible to compare subjective assessment of athletes with those of their coaches - Should be possible to supplement the subjective data with objective performance measures and to integrate training schedules - Symbols for the single curves (house, heart etc.) - Smileys instead of a numerical scale from 0 to 10 would be more appealing - For use as an athlete's diary: personalization through photo uploads and use on several end devices	- Problem of social desirability should be taken seriously. It is likely that athletes will not share certain information (with regard to stress, private life, relationships, and family) with their coaches - How will data be used? What is the added value? Athletes do not recognize a clear benefit - When and how often will the assessment take place? How long will it take? - Reconstruction over a longer period of time appears to be inaccurate. Athletes suggest a regular assessment through themselves instead of a punctual assessment though the coach. But then it has to be possible to hide certain curves from the coach.

From the athletes' point of view, biographical mappings are also an interesting tool for self-reflection. The data would not necessarily have to be shared with the coach in order to draw one's own conclusions, or could just be used as a basis for a subsequent discussion with the coach.

Summary and conclusion

The need for holistic health-related care and individual training management was recognized and accepted with broad consensus. The instrument itself was also seen as useful, as it can provide important information that is often difficult to access. In addition, the added value of the initiation of self-reflection processes was mentioned, which in particular can provide a basis for discussions between coaches and athletes and also enables athletes to critically examine their own careers.

However, it also became apparent that the direct benefit of the software for coaches and athletes must be made more obvious. Although an added value was noticed, it

was viewed rather critically with regard to the time required for conducting a biographical mapping. In particular, the time required for the planned assessment through the coaches was viewed very critically (e.g. quote from a coach: "this should take a maximum of 10 minutes").

The full potential of a reconstruction of biographical processes for the daily training practice was apparently not yet fully recognized. In this regard, coaches and athletes often voiced the concern that the curves would not be exact and that only rough approximations would be possible, especially for longer periods of time (e.g. because one does not remember exactly). The participants therefore repeatedly asked for an accompanying, prospective entry in order to obtain 'more accurate' data. Coaches and athletes agreed that a software, which allows an entry at regular intervals or after significant events, would be useful for athletes. A subset of curves that athletes themselves would collect and select could then be made available to the coaches.

With regard to the developmental curves, the following particularly relevant developmental variables were identified:

- Perception of stress
- Subjective and 'objective'/biological health
- Performance-related variables
- Motivation/fun at volleyball
- Nutrition-related variables

An exact formulation of the labels of the curves proved to be difficult. A central problem was the question of when the software should be used and how it should be implemented.

2.2.4 Process Evaluation Phase I

On the basis of the first development steps and in particular the feedback from the first workshop, the following conclusions were drawn:

- The design should be as modern and appealing as possible so that the program is accepted by the athletes.
- The programming of a prospective 'athlete diary' is not possible within the specifics of this project, but should be pursued in the future.

In addition, based on the evaluation, we developed three application scenarios for the software, which were to be clarified again in the second expert workshop:

1. **Tool for coaches for the initial assessment of new team members** in order to create a general understanding for the individualized training management by identifying individual opportunities for further development and already existing health problems.

2. **Tool for coaches for the systematic optimization of health and performance management.** This could take place once a year before the beginning of a new season within the framework of newly implemented 'talks about development' with athletes. The graphically supported reflection and evaluation of the past season could help to derive health-related and performance-related opportunities for further development, identify long-term health problems at an early stage, and observe overarching problem mechanisms at the team level (e.g. systematic overload).

3. **Scientific instrument** for identifying typical high-stress phases and health-sensitive phases in athletes' biographies in top-level volleyball (accompanying scientific study).

The data generated with the first two practice-oriented application scenarios could also be analyzed in aggregated form for scientific purposes.

2.3 Project Phase 2 - Conception and Development of Alpha and Beta Versions

2.3.1 Development and Programming of an Alpha Version

Based on the feedback from the first workshop and the further specification of the application scenarios, the 'pre-alpha version' was further developed into a first alpha version. Here, we placed a particular focus on the functional design. Through several internal test runs and discussions with our IT specialist, we were able to develop a basic design that allows an intuitive data collection and analysis. In particular, we considered the following points:

- Visual and color arrangement as well as the labeling of the tabs and the coordinate system
- Implementation of the assessment from the start of the software till completion → User-friendly implementation
- Possibilities of data collection with regard to biographical events and curve courses

The process of data collection with the alpha version of the bioMAP software is depicted in Table 3:

Table 3: Process of data collection with the alpha version

1. Start screen: *Open study*
Project → Select an already created project from the folder Message on how many persons were already registered in the project pops up → *Ok*. Afterwards, further tabs are opened in the headline
2. Tab: *Create/edit person*
Select existing person or create a new person → *New* → First name, surname or pseudonym To delete existing person → *Delete*
3. Tab: *GesMAP*
Can only be selected when a person is chosen Enter biographical events → *Enter events* or double click on the time line → Date, type of event (e.g. athletic, school-specific, private) and enter description To assess developmental curves → *Draw curves* → Select curve → Draw → Draw the curve course by hand (on tablet) or with mouse (laptop)
4. Tab: *Analysis*
Select curves that you want to analyze Events are depicted in different colors on the time line (e.g. athletic event = red) Description of events is displayed in a pop-up window

5. Tab: *Options*
Selected curve courses can be *exported as an image* Click on f*inalize study* → Changing the data is not possible any more

In addition, it has been ensured that the assessment is saved automatically while using the app. In case of crashes or problems, the assessment can be continued at a later point in time. This feature allows coaches, for example, to enter personal data and thus 'prepare' the survey and carry it out at a later point in time.

In terms of content, the following labels for the curves were selected based on the salutogenetic health model (see Chapter 3.3.1) and the feedback from the first workshop:

- Health indicators
    - General state of health
    - Psychological well-being
    - Physical functioning
    - Athletic performance capability
- Stressors
    - Sport load
    - School load
    - Private burden
- Resources
    - Implementation of recovery measures
    - Implementation of injury prevention measures
    - Implementation of a sport-specific diet

However, these labels appeared to be too abstract and not differentiated enough for sports practice. Thus, we also compiled a battery with possible curve labels in preparation of the second expert workshop. During this workshop, we aimed to evaluate these labels through representatives from sports practice with regard to their relevance and usefulness (cf. Chapter 2.3.3, Table 5).

2.3.2 Preparation and Organization of Expert Workshop II

Based on the feedback from the first meeting, we decided to discuss the underlying theoretical assumptions of the biographical mapping approach and the possible application scenarios with representatives from sports practice in the second workshop. In this regard, we wanted to demonstrate the added value of a retrospective assessment – based on the assumption that thinking about the past has a decisive influence on future actions and emotions. Studies on coach behavior (Schubring, Bub & Thiel, 2014) show that past experiences can influence present behavior. A further advantage that we wanted to demonstrate lies in the conversation-supporting function of the approach, which enables athletes to visualize sensitive topics and gives coaches the opportunity to detect hidden events, patterns, and connections in an explorative manner.

Based on the results of the first workshop, we also wanted to discuss the question of when the biographical assessment should be carried out. Here, we wanted to propose the following three application scenarios for elite sports:

1. Initial assessment of new athletes
2. Assessment at the end of the season for evaluation purposes
3. Analysis of acute problems (depending on need and situation)

In addition, we aimed to present the correct usage of the software to coaches, athletes, and branch managers in one-on-one meetings. For this purpose, the assessment process (creating/deleting persons, entering biographical events, and selecting/drawing curves) and the analysis (selecting and comparing curves) was demonstrated exemplarily. In addition, we conducted an exemplary assessment with a volleyball player from our university in order to illustrate the different functions.

Finally, as described in the previous subchapter, we also wanted to evaluate the practical relevance of different developmental curves. For this purpose, we prepared a questionnaire in which we asked coaches, athletes, and representatives of the branch management to rate the different developmental curves on a 5-point Likert scale with regard to the perceived relevance (cf. following chapter, Table 5).

2.3.3 Implementation and Evaluation Expert Workshop II

The goal of this second, two-day expert workshop taking place from February the 14th to February the 15th, 2017 was the further optimization of the alpha version beside the points already mentioned. In this context, we sought feedback on the following points:

- Practicability and implementation requirements for the assessment
- Comprehensibility and visual design of the software
- Evaluation of the practical relevance of selected developmental curves

The basic software functions were explained to athletes and coaches as well as to the management of the branch office in one-on-one discussions. This included information on how to create a new person, enter biographically relevant events, and reconstruct the pre-selected curve courses (general subjective state of health, sport load, school load, athletic performance capability, quality of sport specific diet, difficulty of organizing daily life). In addition, the three identified application scenarios of the assessment tool (assessment of new athletes, evaluation at the end of the season, acute problems) and the initial idea that the reflection on past events has a decisive influence on the present experience and future action were explained once again. To illustrate this, an exemplary dataset was shown, which was also used to illustrate the analysis of the curves while taking into account the biographically relevant events. Feedback was obtained from each participant. Finally, all workshop participants completed a questionnaire designed to assess the practical relevance of selected curves.

In general, the software and the proposed application scenarios were received very positively. The underlying potential was recognized by both coaches and athletes. Especially the athletes showed great interest in the assessment tool. Table 4 shows a summary of the feedback of the workshop participants.

Table 4: Results workshop II

Results from the coaches' perspective	Results from the athletes' perspective	Results from the management's perspective
- Athletes have to enjoy the assessment and the added value has to be communicated clearly. - Athletes have to take the assessment seriously. → Coaches design their training in response to the results of the assessment. Hence, athletes can actively influence the training management. Dishonest answers affect the athletes negatively. → Thus, athletes have to be aware of the added value that has to be in the right relation to the required effort. - Mappings represent a good guide for the "end-of-the-season" talk because the athletes have the opportunity to reflect on their season in advance. This is good because usually there is not enough time for reflection during an athletic season. - Inter-individual comparison is important - For the future: Software could recognize critical life events and certain patterns so that the coach does not have to search for those. - Assessment should work independently of the coach.	- Mappings are a good tool for coaches who are new or not that experienced and who do not know the team yet. - Independent assessment after an introduction session is easily possible, but they need time for it. - Would prefer regularly scheduled assessments over shorter periods of time (after half a year or after the major sport competition) and a one-time assessment for longer time frames (to observe the development of their own biography and career). - Shorter time frames and more data collection points are perceived as important with regard to early intervention efforts. - Reflection on critical life events is perceived as added value. → Could also be used for oneself without the coach looking at it; tool for self-reflection on personal life and career development	- Athletes should be given enough time for completing the bioMap (could be done at home). → But should not take longer than 1 hour (limited time frame could be assessed and only a limited number of curves) - Shorter assessment frames are preferred. → Would be good if those could be combined into one biographical mapping at the end - Possibility to enter pre-determined events in advance that every athlete experienced and that were selected by the coach → Facilitates inter-individual comparison and could support memory and serve as an orientation point (e.g. training camps, important tournaments) - Results are also relevant for administration particularly when planning the competition and travel schedule (would enable them to take school load into account). - Several assessments allow to observe career development (regional league → 3rd league → 2nd league → 1st league). - Inter-individual comparison particularly important (compare the perception of the athlete with the one of the coach)

After the one-to-one discussions, we distributed the prepared questionnaires in order to assess the practical relevance of the proposed curves. The selection of the curve labels was guided by the information collected at the first meeting and the variables used in previous studies. The experts were asked to rate the practical relevance of each curve on a 5-point Likert scale, with values ranging from 1 = not important at all to 5 = very important.

The results (see Table 5) show both mean values and standard deviations. Since this is not an existing and validated questionnaire, a cut-off value of ≥ 4 was defined for curves that appear to be of particular importance. These are highlighted in bold in the table.

Also worth considering are the variables that were classified as quite important and had a value of ≥ 3 and < 4 (depicted in italic in the table).

Table 5: Descriptive statistics - expert ratings (n = 6)

	Min.	Max.	M	SD	Relevance
General health status	**4**	**5**	**4,67**	**,516**	**+**
Psychological well-being	**2**	**5**	**4,00**	**1,265**	**+**
Physical well-being	*2*	*5*	*3,83*	*1,329*	±
General well-being	*2*	*5*	*3,67*	*1,033*	±
Physical complaints	**4**	**5**	**4,83**	**,408**	**+**
Athletic performance capability	**4**	**5**	**4,83**	**,408**	**+**
Performance capability in school	**3**	**5**	**4,00**	**,894**	**+**
Sport load	**4**	**5**	**4,83**	**,408**	**+**
School load	**4**	**5**	**4,67**	**,516**	**+**
Burden from private life	*3*	*5*	*3,67*	*,816*	±
Perceived training load	*1*	*5*	*3,50*	*1,643*	±
Perceived competition load	*1*	*5*	*3,67*	*1,751*	±
Quality of injury prevention efforts	1	5	3,00	1,414	−
Quality of sport-specific diet	*2*	*5*	*3,67*	*1,033*	±
Quality of recovery measures	*2*	*5*	*3,50*	*1,378*	±
Pressure in sport	**2**	**5**	**4,00**	**1,095**	**+**
Pressure in school	*2*	*5*	*3,83*	*1,169*	±
Pressure through family	2	4	2,67	,816	−
Subjective relevance of sport	2	5	3,00	1,265	−
Subjective relevance of school	2	4	2,83	,983	−
Subjective relevance of digital networks	1	4	2,50	1,225	−
Relevance of athletic success	2	5	3,17	1,169	−
Relevance of success in school	2	5	3,17	1,169	−
Relevance of peer group outside of sport	1	4	2,50	1,049	−
Relevance of peer group within sport	2	4	2,67	,816	−
Relevance family	2	4	2,67	,816	−
Expenditure of time for sport	*1*	*5*	*3,50*	*1,761*	±
Expenditure of time for school	*1*	*5*	*3,67*	*1,751*	±
Expenditure of time for family and friends (face-to-face)	*1*	*5*	*3,50*	*1,643*	±
Expenditure of time for family, friends, follower (digital)	*1*	*5*	*2,83*	*1,722*	-
Support from family	*1*	*5*	*2,67*	*1,366*	-
Support from friends	*1*	*4*	*2,50*	*1,049*	-
Support from coach	*1*	*5*	*2,83*	*1,329*	-
Support from team	*1*	*5*	*3,00*	*1,414*	-
Well-being in the team	***3***	***5***	***4,17***	***,983***	**+**
Difficulty of organizing daily life	***2***	***5***	***4,17***	***1,329***	**+**

In addition, athletes proposed to also include a motivation curve for sports and school.

Summary and conclusion

Compared to the first meeting in September 2016, the added value of the bioMAP software became more obvious. A clear delineation of the underlying assumptions of a retrospective approach was particularly useful when illustrating the difference to other assessment instruments that usually aim for real-time recording with a prospective focus. Particularly the athletes who expected a kind of diary app at the first meeting were "positively surprised".

The three described application scenarios were received very positively, but more frequent assessments over somewhat shorter time periods were suggested. These regularly-scheduled assessments over an athletic season could then be supplemented by a longer assessment spanning one to four years. This would allow to identify biographical disruptions and compare the results of the different assessments with each other.

It proved to be extremely important to clearly communicate the benefit of a retrospective approach to the athletes. It is important to emphasize that the subjective evaluation of 'objective' events might differ between athletes and coaches. Instead of viewing this discrepancy as a problem, the identification of these differences might be really helpful because it helps coaches and athletes to better understand the perspective of the respective other.

All participants regarded the inter-individual comparison, e.g. within a team or between players on the same position, as an essential analysis tool. In addition, the perceptions of the athletes could also be compared with the coaches' perceptions.

The reflection on biographical events and the provision of these data to the coach, who then analyzes those, could form an important basis for coach-athlete talks and could noticeably increase their quality. The potential depth of information obtained through the assessment was perceived as very positive and participants believed that the tool could make a lasting contribution to individualized training management.

2.3.4 Development and Programming of a Beta Version

Based on the feedback provided during the second workshop, we concluded that the software development was on the right track with regard to content and visual design as well as usability. The further development of the presented alpha version to a stable beta version, which allows a completely functioning assessment without any troubles, was the next goal.

In close contact with our programmer, the software was further optimized and the initial troubles were eliminated. The basic functions of the alpha version remained largely the same or were partly extended. Table 6 shows the data collection process with the beta version.

Table 6: Process of data collection with beta version

1. Start screen: Open study
Project → Select an already existing project from the folder Message on how many persons were already registered in the project pops up → *OK* Afterwards, further tabs are opened in the headline Under the tab *Study* relevant study information is displayed (e.g. date of creation, date of change; scale of the x-axis, selected developmental curves)
2. Tab: *Create/ edit person*
Select existing person Add a new person → *New* → Enter first name and surname or pseudonym Delete existing person → *Delete*
3. Tab: *GesMap*
Can only be selected, when a person was chosen Enter critical life events → *Enter events* or double-click on the time line → Date, type of event (e.g. athletic, school, private), enter description and label Collect developmental curves → *Select curves* → Select curves *Draw* → Drawing the curves is only possible when the tab *Draw* is red → Draw the curves by hand (tablet) or with mouse (laptop)
4. Tab: *Analysis*
Select the curves to be depicted Events are displayed in different colors on the time line (e.g. athletic event = red); description of event is displayed in a pop-up window or if labelled, the labelled event is directly depicted
5. Tab: *Options*
Selected curve courses can be *exported as an image* *Export data into excel* *Finalize study* → Changing the data is not possible anymore

Particularly the feature to export the data into Excel is helpful for the subsequent data analysis.

2.3.5 Process Evaluation Phase II

After several minor revisions, a fully functioning beta version for use by coaches and athletes was developed. The very positive feedback during the second expert workshop encouraged us to collect data from around 20 young elite athletes in a third meeting scheduled for April/May 2017. We aimed to use the resulting knowledge for the fine-tuning of the software. Additionally, we decided to use the collected data for a first analysis in order to assess the potential of the assessment tool with regard to the identification of typical curve courses and patterns.

2.4 Project phase 3 – Tests, Documentation, and Design of a Release Candidate

2.4.1 Preparation and Organization of the Beta Test

The final phase of the project was characterized by a focus on the scheduled test of the beta version. Here, we aimed to use the new software to collect data from at least 20 young elite volleyball players at the German federal youth training base in Berlin. We had two objectives in mind: First, we wanted to test the software in a practical context to identify possible bugs. Second, we aimed to collect data that could be used for identifying typical behavioral and developmental patterns. This could serve as an interpretation tool for coaches in the long term.

To conduct such an assessment, we had to decide on the developmental curves we wanted to assess, their definition and their operationalization for the interview guide. Based on the feedback during the second workshop, we agreed to assess the developmental curves depicted in Table 7.

Table 7: Developmental curves - label, definition, and operationalization

Health indicators		
Label	*Definition/description*	*Operationalization*
Subjective health	Self-report or the general health status (cf. RKI, 2014)	How would you rate your general health status?
Physical complaints	Self-report of physical complaints (e.g. pain etc.)	What is the degree of physical complaints such as pain?
Athletic performance capability	Self-report of physical and mental performance capability in sport or of all abilities and skills that are needed to perform a task successfully (see Sargirli & Kausch, 2007)	How good is your athletic performance capability in general?
Well-being in the team	Own well-being within the sport team (cf. Lucas & Diener, 2008)	How satisfied are you within your team?
Motivation for training	Active and goal-oriented intention or willingness to start, maintain, and practice sport-related activities (cf. Becker-Carus & Wendt, 2017, p.486)	How motivated are you for training?
Motivation for school	Active and goal-oriented intention or willingness to start, maintain, and practice education-related activities (cf. Becker-Carus & Wendt, 2017, p.486)	How motivated are you for school?
Stressors		
Label	*Definition/description*	*Operationalization*
Sport load	All athletic influences and demands that affect the individual (on a physical, psychological, social level) → individual response = stress (see Krause, 2003, p.256; Van Dick & Stegmann, 2007, p.35)	How high is the burden you experience from sport?
School load	All education-related influences and demands that affect the individual (on a physical, psychological, social level) → individual response = stress (see Krause, 2003, p.256; Van Dick & Stegmann, 2007, p.35)	How high is the burden you experience from school?
Difficulty of organizing daily life	Subjectively perceived degree of coping with the demands of daily life	How difficult is it to organize and cope with daily life?
Quality of sport specific diet	Self-report of own diet (balanced diet, etc.)	How good is the quality of your diet?
Resources		
Label	*Definition/description*	*Operationalization*
Perceived support from family	Subjectively perceived social support from the family → help from others to stay healthy and feel well (see Gasser-Steiner & Freidl, 1995, p.69-71)	How high is the perceived support from your family?
Perceived support from coach	Subjectively perceived social support from the coach → help from others to stay healthy and feel well (see Gasser-Steiner & Freidl, 1995, p.69-71)	How high is the perceived support from your coach?

Based on these reflections, we developed an interview guide for the assessment, which also included questions on the perception of the assessment tool and the interview itself. The feedback provided in response to the latter questions could then be used for finalizing the software. In addition to the biographical mapping, two health-related questionnaires, namely the Salutogenetic Health Indicator Scale (SHIS) and the EQ-5D-3L, were included. In addition, sociodemographic and sports context-related information was collected using a part of the GOAL questionnaire (cf. Thiel et al., 2011).

We pretested the software and the interview guide for practicability and comprehensibility with a semi-professional cyclist. This only resulted in minor changes to the procedure. Overall, this test demonstrated that the biographical mapping method stimulates detailed self-reflection and that after a brief adjustment period, the participant quickly got used to the software.

2.4.2 Performing the Beta Test in the Field

The beta test took place from April 25th to April 27th, 2017 at the German federal youth training base for Volleyball in Berlin. The software was tested with 24 athletes (12 females, 12 males). The interviews were conducted by three trained scientific project staff members. The athletes were informed about the goal of the study before the interview and anonymity was assured. All conversations were recorded with a digital recording device. The duration of the interviews ranged from 45 to 90 minutes.

2.4.3 Results and Evaluation of the Beta Test

The scientific team had the following impressions with regard to the methodological procedure: A differentiated approach makes sense for the recording of biographically relevant events. On the one hand, open questions should be asked ("What do you remember from last year?"), but on the other hand, it is also of help to collect standard events that do not have to be of personal relevance (such as the beginning of the season, end of the season, beginning and end of the school year, holidays, major sporting events). In addition, it is often necessary to enter individually significant events over the course of the assessment (e.g. relevant events mentioned with reference to a certain curve), and not only at the beginning of the interview. With regard to the curve labels, a clear and unambiguous description or definition is necessary.

One limitation is the fear of the athletes to say or enter anything 'wrong'. This often resulted in memory gaps. In addition, we observed that athletes rarely talked about private events. Accordingly, this area of the biography remains hidden. In this respect, further investigations with an explicit focus on private events would be useful. Finally, it should be discussed what the interviewer is allowed to do with the data after data collection. For example, it remains to be discussed whether the interviewer is allowed to enter additional information from the interview material (that was not entered during the interview because of a lack of time and the fast progression of the interview) or whether the interviewer is allowed to smooth curves (when the drawing did not work well and unwanted peaks occurred). These points are particularly important when the software is used as a scientific assessment tool; they might not be as relevant for a practical application scenario.

The athletes' feedback with regard to the software and the interview was consistently positive. For example, the handling of the software was perceived as very intuitive and the athletes really enjoyed drawing the curves and completely forgot the time when doing so. In many cases, we noticed that drawing the curves was easier than talking about the topics. The drawn curves in turn encourage self-reflection, which can often be used by the interviewer for further conversation, particularly about sensitive topics.

The pre-defined curve dimensions were perceived as very good. There were hardly any suggestions for improvement in this respect. With regard to the 'subjective health' curve, however, it was suggested to make a distinction between physical and psychological well-being. In addition, athletes proposed to conduct the assessment at shorter intervals (e.g. every three months or every few weeks) in order to gain more precise assessments of health-related developments. Furthermore, athletes seemed to be highly willing to use the software independently of their coaches. Some athletes asked whether the instrument would be made available to them personally.

2.4.4 Further Development of the Beta Version to the Release Candidate

The field test of the beta version confirmed that a functional and easy to understand version of the bioMAP software was developed. Only during the initial analysis, the scientific team recognized a need for optimization in a few areas. In consultation with our programmer, software changes had to be made with regard to the Excel export feature and the depiction of biographical events on the x-axis. In addition, a solution was to be found for merging several data sets collected on different devices.

After solving these problems, the beta version was further developed into the final release candidate. This software version is now ready for use both for scientific research as well as elite sports practice.

2.4.5 Process Evaluation Phase III

At the end of the third project phase, the central objective of the service project, namely the development of an analytical tool that enables intra- and inter-individual comparisons of complex, biopsychosocial health trajectories of young athletes was achieved. With the development of the bioMAP software, coaches and scientists now have a tool at their disposal, which enables a simple recording, immediate analysis, and interpretation of health-related developments.

Based on the results of the field test, a user-friendly and easy-to-use software was developed that is very popular with the athletes. The intuitive handling when drawing the curves stimulates reflection and supports athletes in the critical examination of their own biographies. In this sense, the bioMAP method provides a benefit for coaches and scientists (knowledge gain) as well as for athletes (self-critical reflection).

3 Description of the Developed Software

3.1 Functions

The bioMAP software is an instrument for the retrospective analysis of complex, biopsychosocial health trajectories in (young) competitive athletes. Based on the

biographical mapping method, subjectively significant life events are recorded and entered in a two-dimensional coordinate system on the x-axis, which is scaled to a fixed time span. The y-axis represents an intensity scale ranging from 0 to 10. The entered life events and phases serve as orientation points for the athletes when they are asked to assess different health dimensions with regard to their subjectively perceived intensity over the time span depicted in the biographical mapping. The drawn curves visually represent the development of the respective health-related dimensions (see Fig. 2).

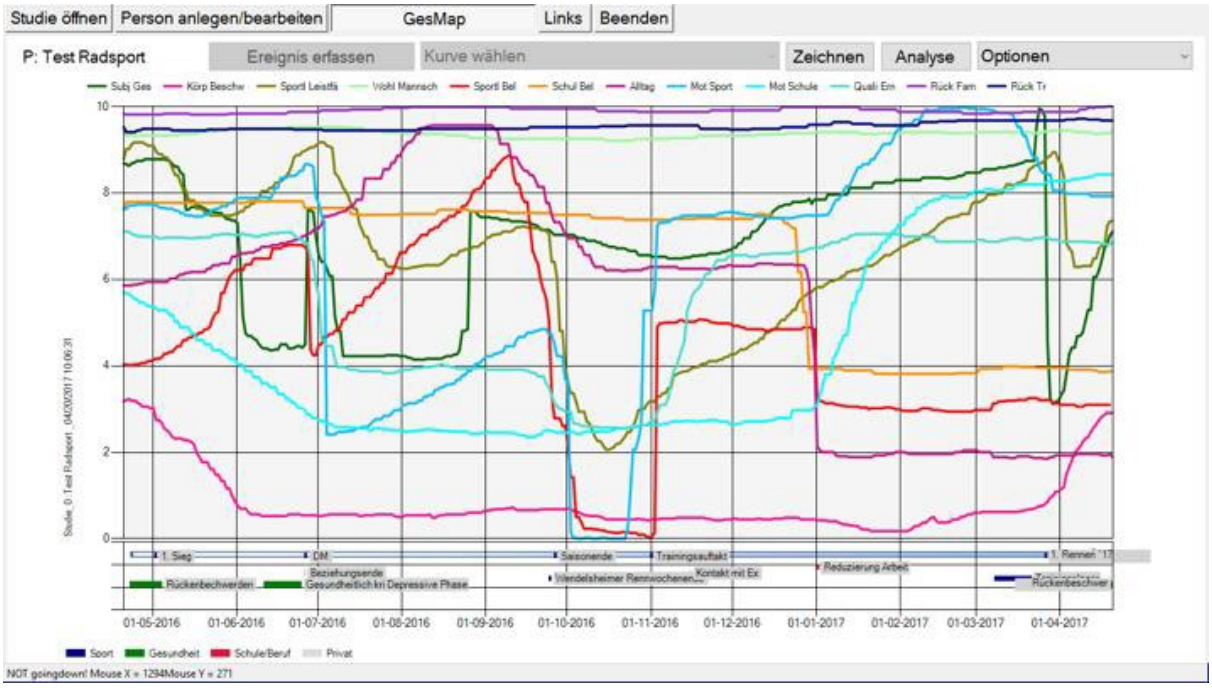

Figure 2: Exemplary result of a bioMAP assessment

3.2 Manual

The software can be installed on a Windows-based tablet. Via the touch screen, it can be operated with simple finger movements or the stylus. In addition, the software can be used on any Windows laptop or PC. Here, it can be operated using the keyboard and the mouse or trackpad. The following chapter describes the use of the bioMAP software.

Technical Background

Basically, the bioMAP software consists of two elements. One is the software itself. Like any other software program, it can be opened via the bioMAP symbol after installation on the tablet, laptop, or PC. The second component consists of a file that determines the content of the software. It contains all relevant study information, such as the current study name, the time scaling of the x-axis, the curve labels and colors, as well as the event categories and colors. This file is in xml format and can be edited via the Windows editor (right click on the xml file and select Open with editor) and modified according to the study design. For example, the study name can be changed,

the period to be investigated can be scaled to the desired length (week, month, year, several years, whole life span), and curves and event categories (depending on the research interest) can be added or deleted. Please make sure that the format in the xml file is retained (see Fig. 3).

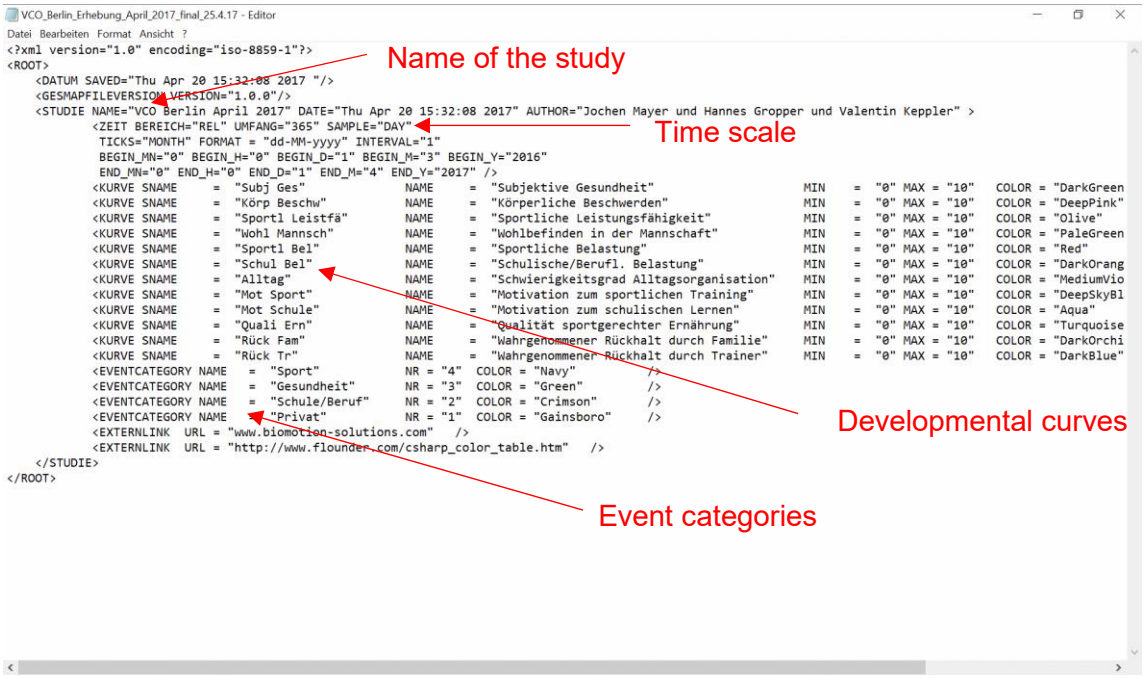


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Figure 3: Editor view of an xml file with all study information

If data are entered in the 'actual' bioMAP program during the assessment (e.g. persons are created or curves are drawn), the program automatically generates an additional folder which is saved under the study name with the suffix .data. This folder updates itself, is stored in the same place as the xml file described above, and contains all study-specific data (e.g. information on persons created). In addition, screenshots and Excel exports are stored in this folder (see Fig. 4).

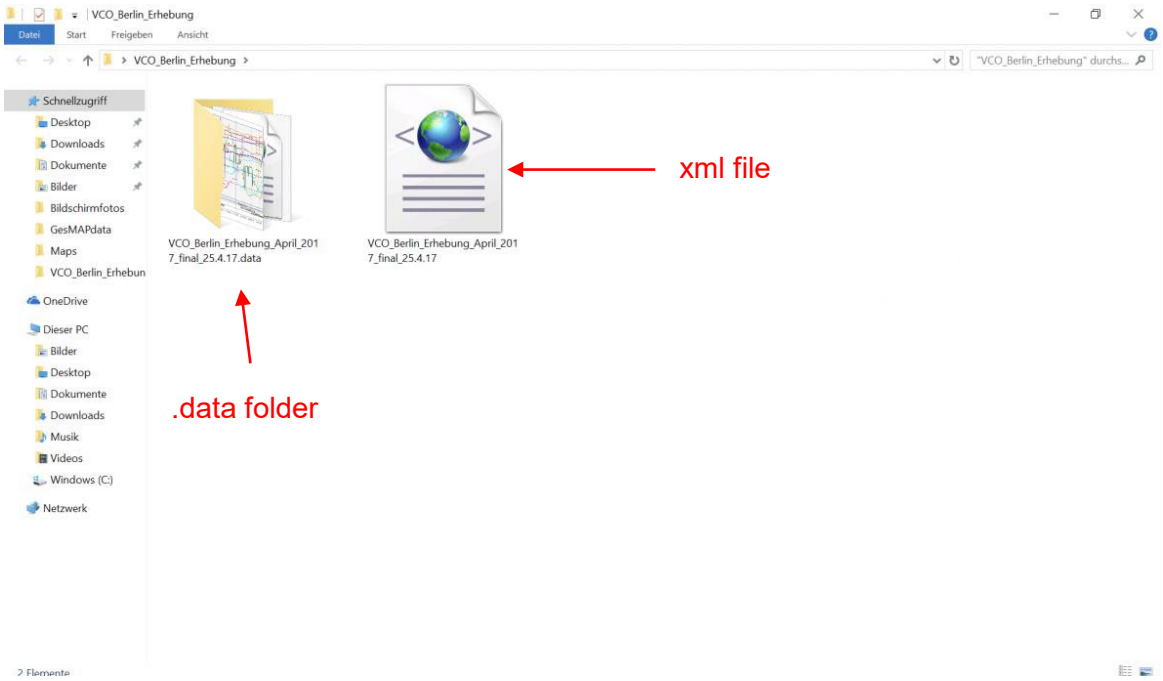

Figure 4: View xml file and the corresponding .data folder

For a new study or for a new participant, it is recommended to create a new xml file with a new study (or participant) name (see above). This will automatically save new assessment data in a new folder. In the following, we will describe the nine steps that are necessary when conducting an assessment with the bioMAP software.

Step 1: Create project and define study specifics

To create a new project, the xml file must first be adapted to the specifics of the study in the Windows editor as described above. At this stage, the study name, time scale, curve labels, and event categories must be defined. To avoid confusion with other projects, it is recommended to assign a unique file name to the xml file (right click on xml file, select Rename and enter new file name).

Step 2: Open the software and start screen

To open the software, first select the program bioMAP. The following start screen appears (see Fig. 5).

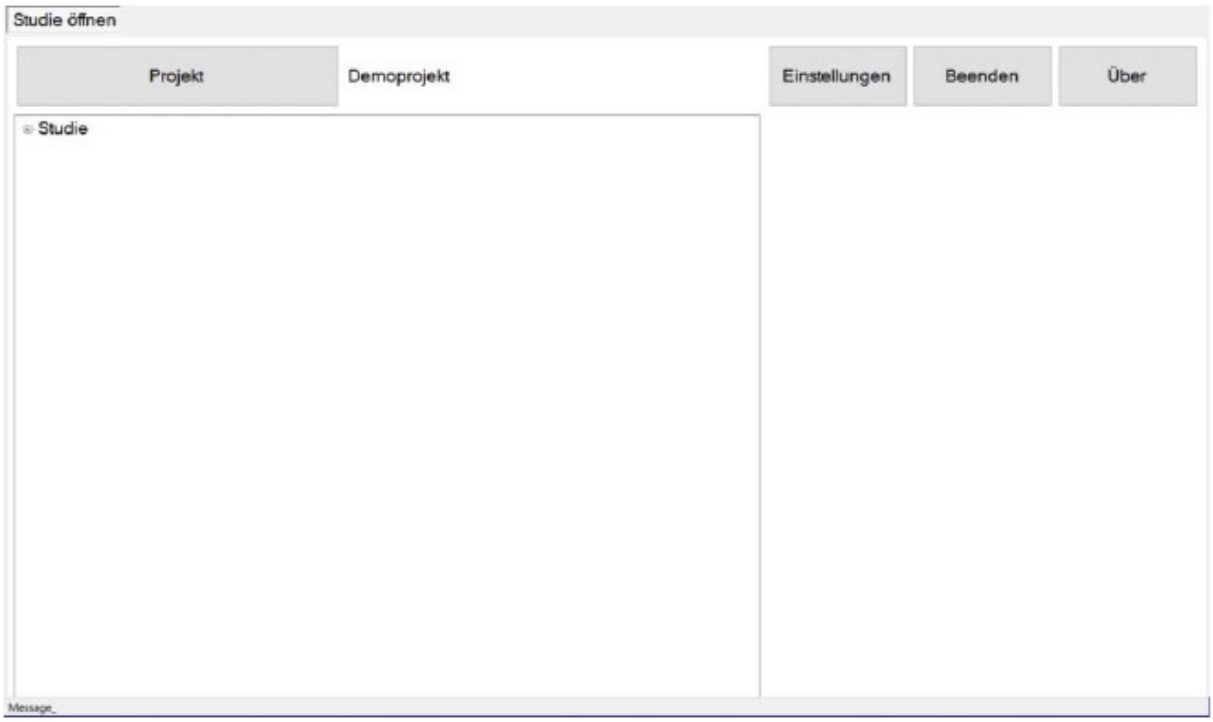

Figure 5: Start screen after opening the bioMAP program

Step 3: Opening a project

To open the already created project, select the Project [*Projekt* in German] button (see Fig. 6).

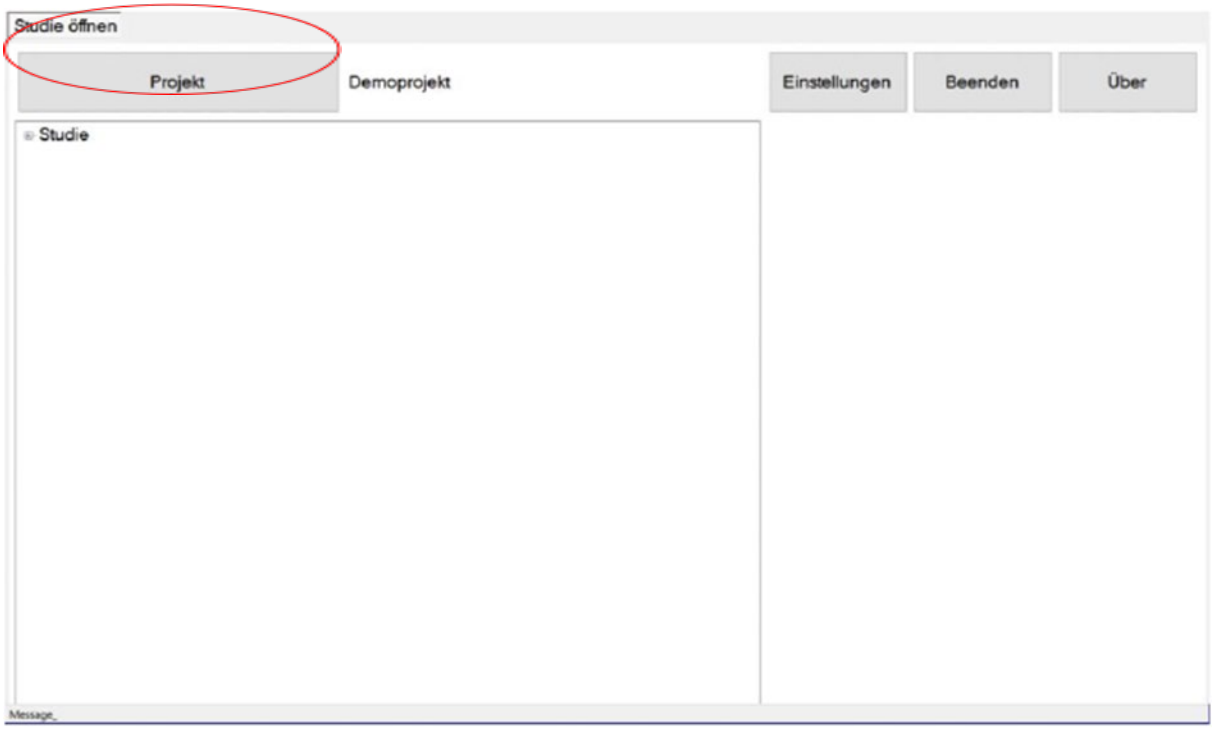

Figure 6: Start screen and open created project

A window opens in which the folder and program structure of the used device (laptop, tablet, or PC) can be viewed and from which the desired study file (in xml format) can be selected (see Fig. 7).

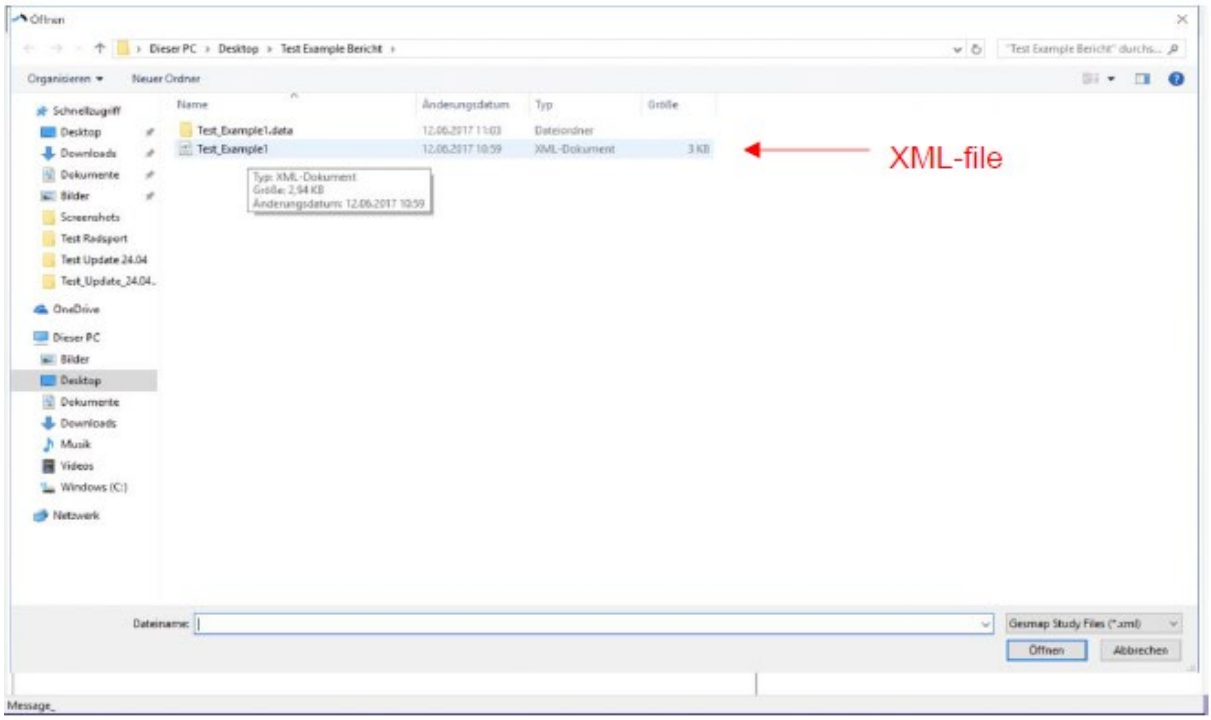

Figure 7: Folder view for opening the xml file

After selection, a message appears that indicates the number of persons that have already been created in the opened study. This message must be confirmed with *OK*.

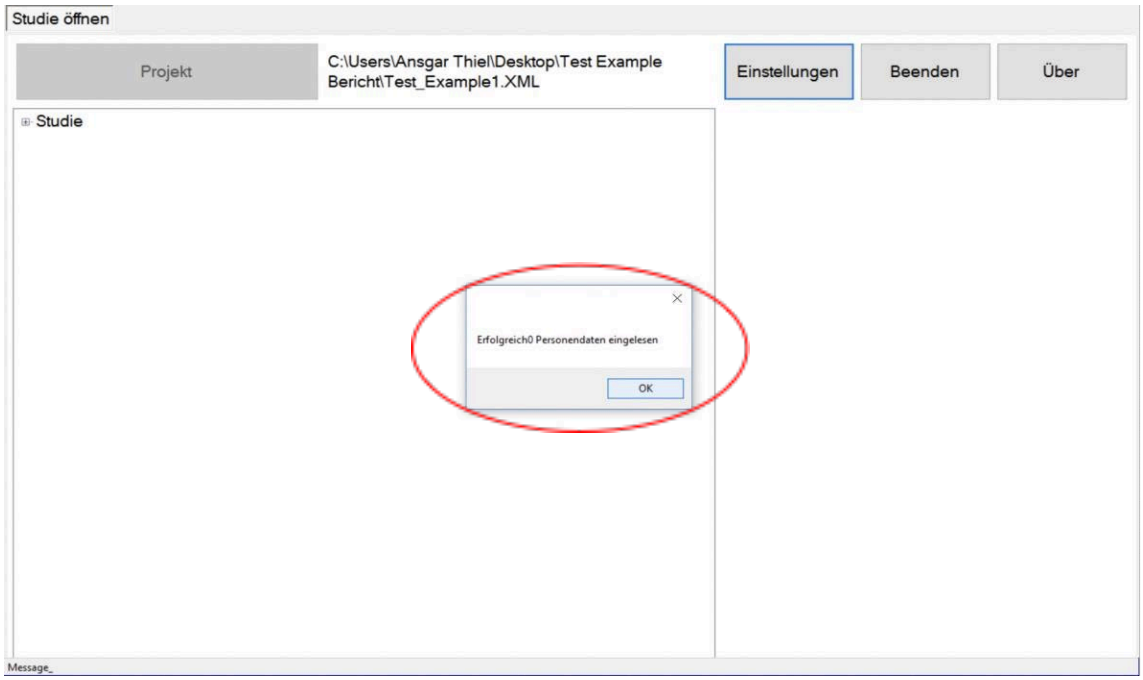

Figure 8: Report on the number of persons created in the study

With the tab *open study [Studie öffnen]*, a drop-down menu with all relevant study information as defined in the underlying xml file can be opened via the item *study [Studie]* (see Fig. 9).

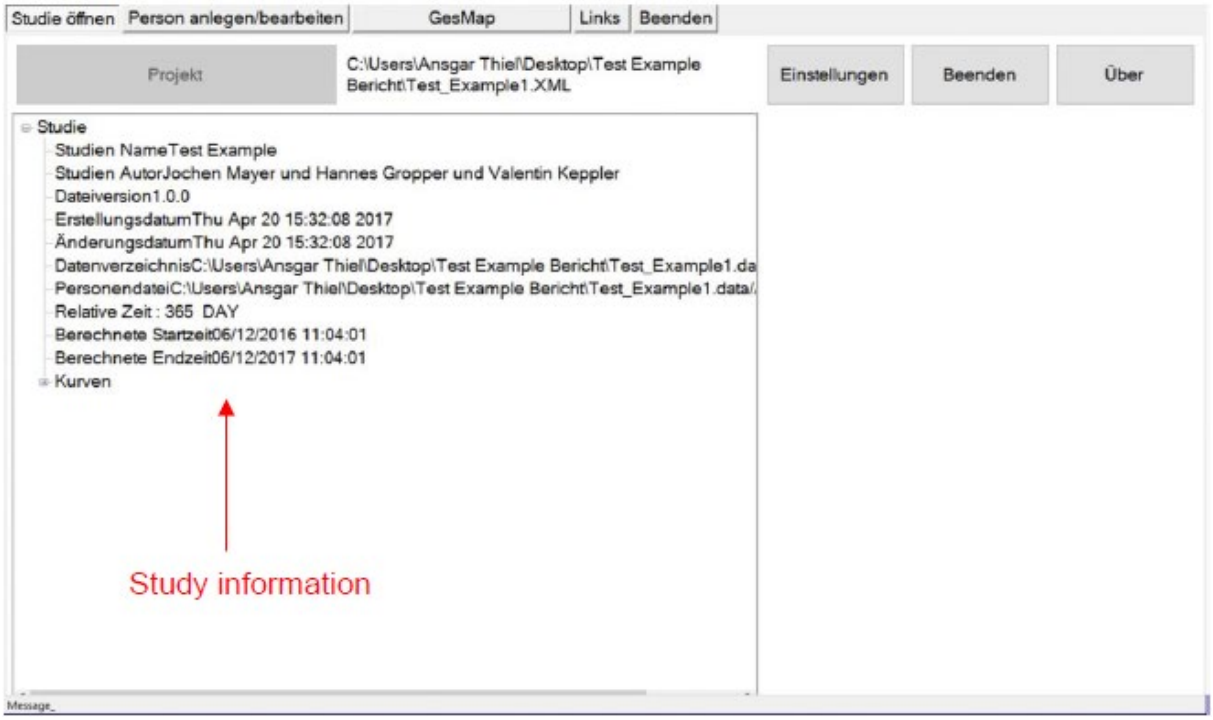

Figure 9: Drop-down menu with all relevant study information

Step 4: Create and edit persons

In the tab *Create/Edit Person [Person anlegen/bearbeiten],* all persons that have already been created are depicted on the left. Using the *New [Neu]* and *Delete [Löschen]* buttons, you can create new persons or delete existing persons. The *Rename [Umbenennen]* button can also be used to rename created persons (see Fig. 10). However, we would suggest to always create a new xml file for each study participant and not use the described feature (this is particularly relevant when assessing the whole life span and having participants of different age).

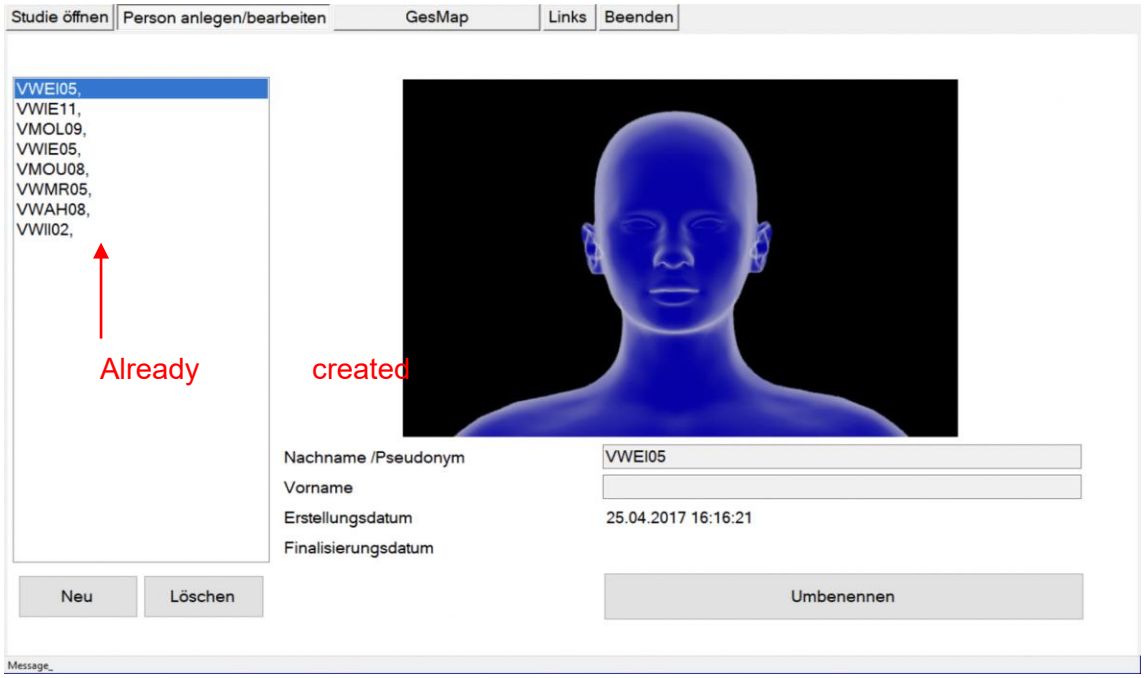

Figure 10: Create/Edit Person tab with already created persons (pseudonymized)

If a new person is to be created, a window opens in which the first name [*Vorname*] and surname [*Nachname*] or a pseudonym can be entered. Only the input of a surname or a pseudonym is obligatory, the input of a first name is optional. The creation of a pseudonym is not obligatory here, but for reasons of data security explicitly recommended. After entering the personal data, they must be confirmed by clicking the *Apply* [*Übernehmen]* button. By clicking on the 'dummy picture', a profile picture of the created person can be added (see Fig. 11).

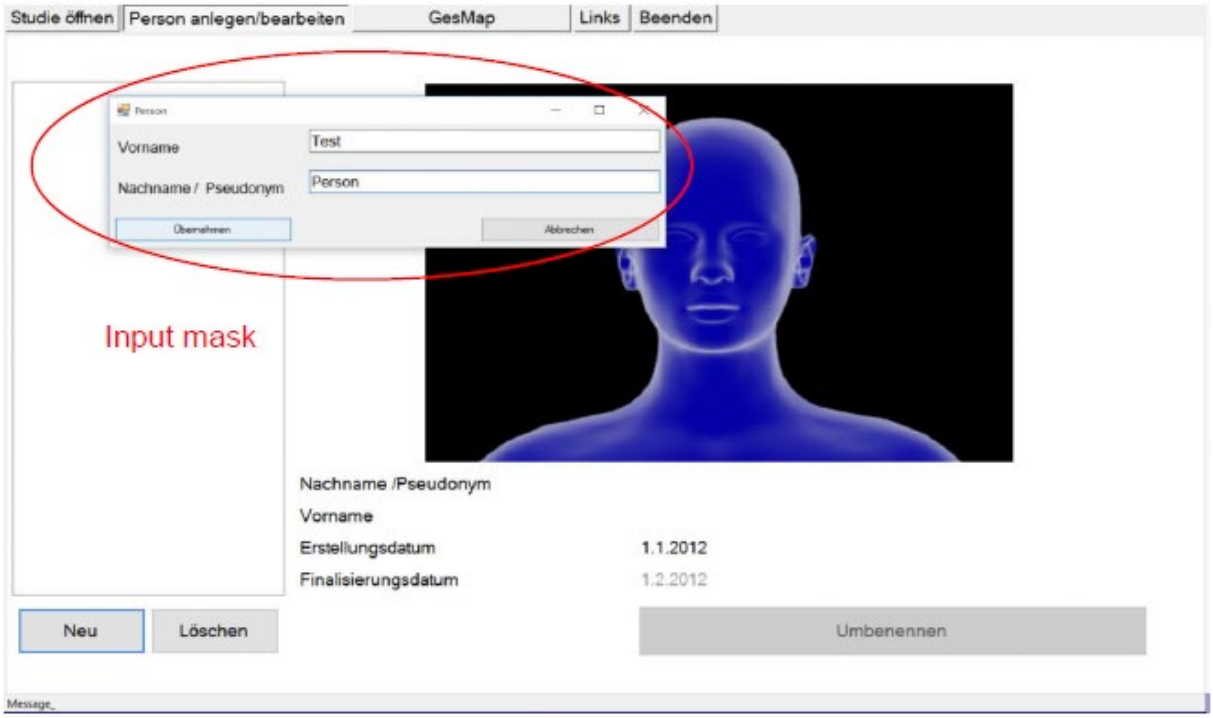

Figure 11: Input mask for creating new persons or renaming already created persons

As already described at the beginning, all changes made in the program are simultaneously saved in the study folder assigned to the respective project (e.g. list of persons and corresponding personal data).

In order to be able to continue working with a specific person in the bioMAP program, this person must be selected from the list of created persons (selected persons are highlighted in blue).

Step 5: Enter biographically relevant events

The main part of the software can be found under the 'GesMap' tab. Here, a work surface opens in which the central two-dimensional coordinate system is displayed. Above the coordinate system, one can find a menu, which shows the name of the opened person (or the pseudonym), as well as buttons for further actions (*record event [Ereignis erfassen], select a curve [Kurve wählen], drawing [Zeichnen], analysis [Analyse], and options [Optionen]*). Below the the x-axis, one can find the predefined event categories (in this example: sports, health, school/work, and private) (see Fig. 12).

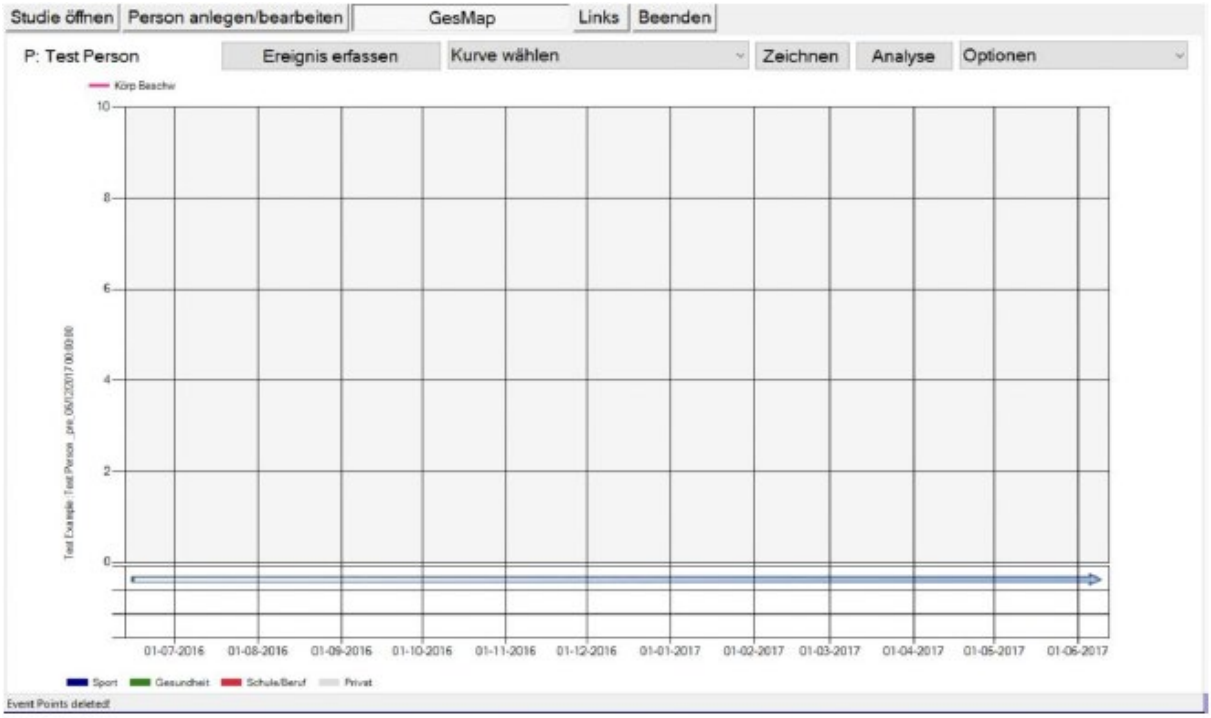

Figure 12: Coordinate system for the collection of the curve courses

The first step of a biographical mapping interview is to collect biographically relevant life events of the interviewees within the time span depicted on the x-axis. Events can be entered either by double-clicking on the field below the x-axis or by clicking on the *record event [Ereignis erfassen]* button. For this purpose, an input mask opens (see Fig. 13) in which the following information can be entered:

- Selection of the event category via drop-down menu (sport, health, school/job, private)
- Select the type of event by ticking the box (singular or phase)

- Determining the date of the event or time span (start and end) by means of a calendar
- Description of the event in the central text field
- Optional: Enter a label that will later be displayed on the x-axis
- At the end, confirm all changes *[Bestätigen]*

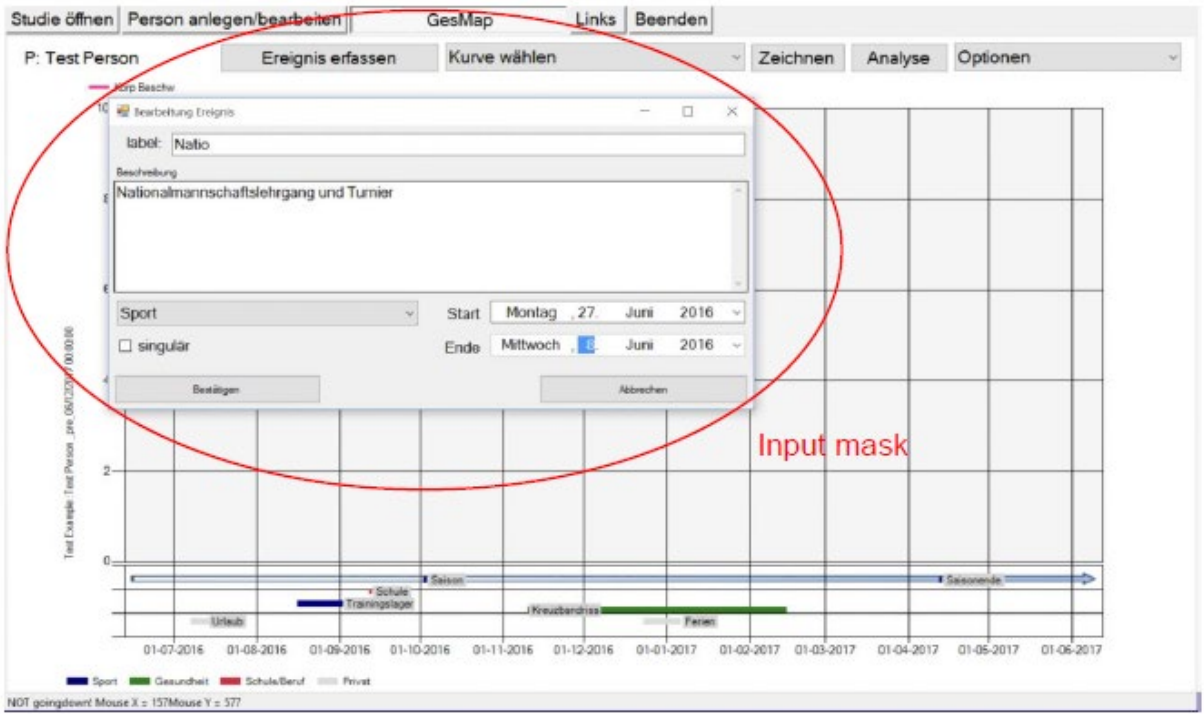

Figure 13: Input mask for recording and describing biographically relevant events

After input, the biographical events are displayed as bars below the x-axis in the color of the respective event category (see Fig. 14). If an event label has been entered, it is displayed at the height of the bar. By tapping or briefly pausing with the mouse on the corresponding bar, a small pop-up window opens, which shows the description of the respective event.

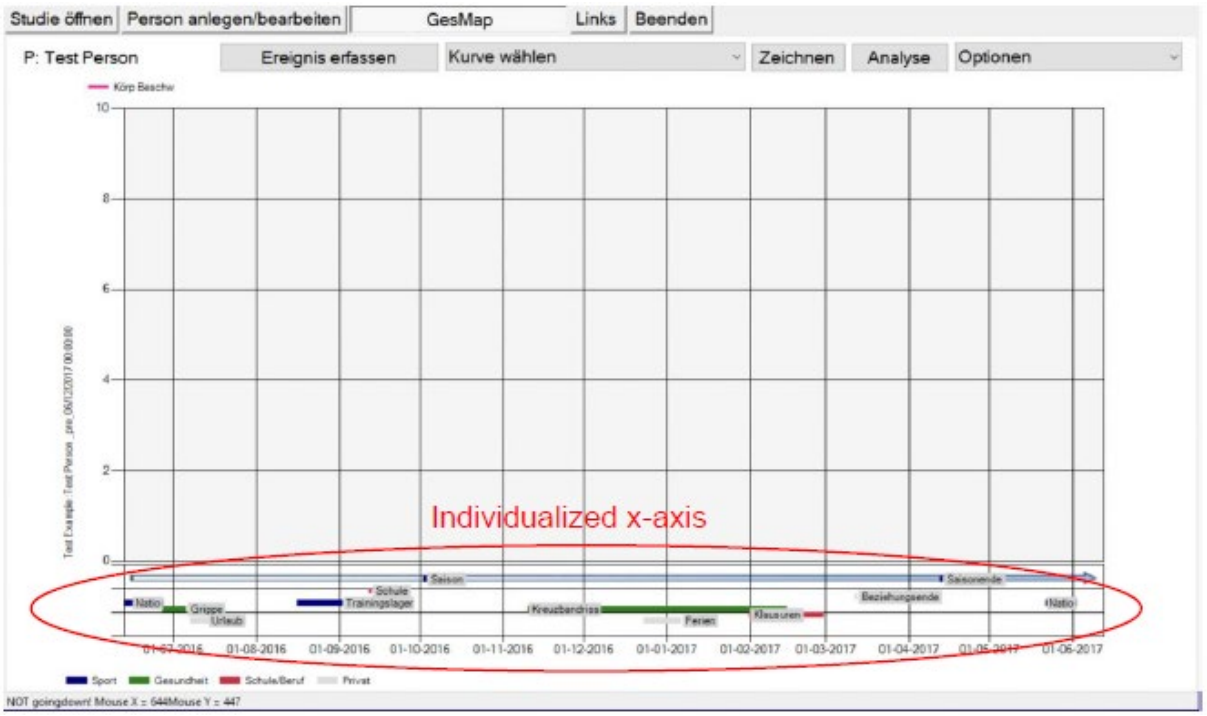

Figure 14: Coordinate system with individualized x-axis

Double-clicking on an event or phase opens a new window with the options *Edit event [Ereignis bearbeiten]* to make changes and *Add event [Ereignis hinzufügen]* to add new events that happened at a similar time (see Fig. 15).

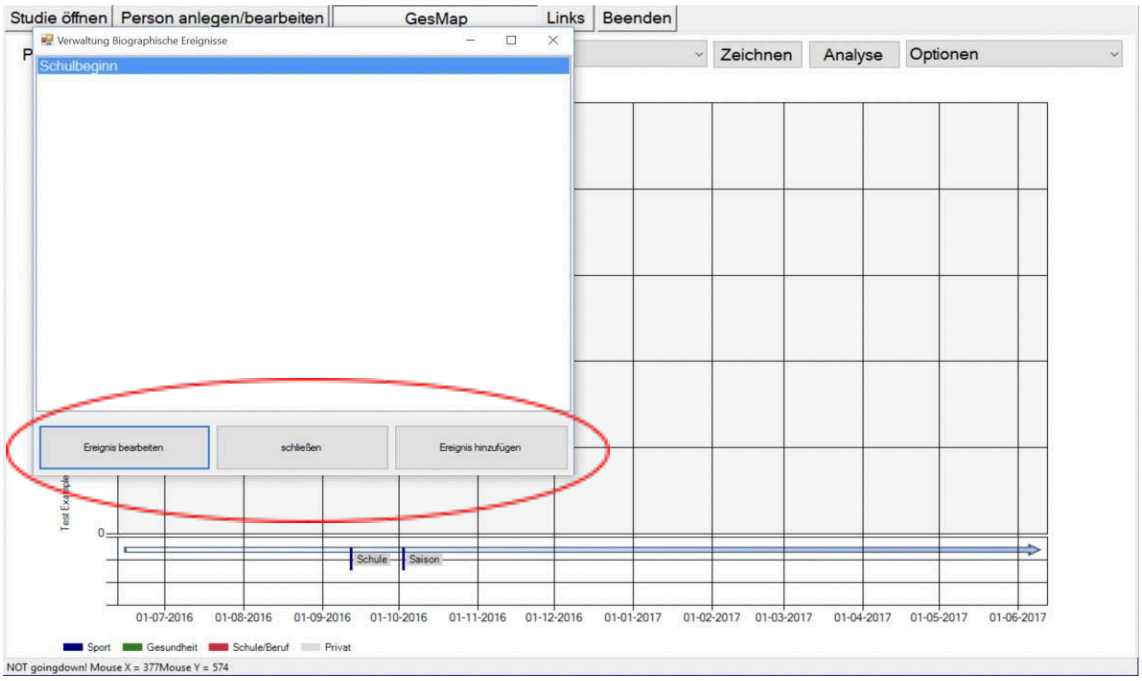

Figure 15: Menu window for editing or creating new events

Step 6: Draw curves

To be able to draw the curves, the respective curve must be selected via the menu item *Select curve [Kurve wählen]* (see Fig. 16).

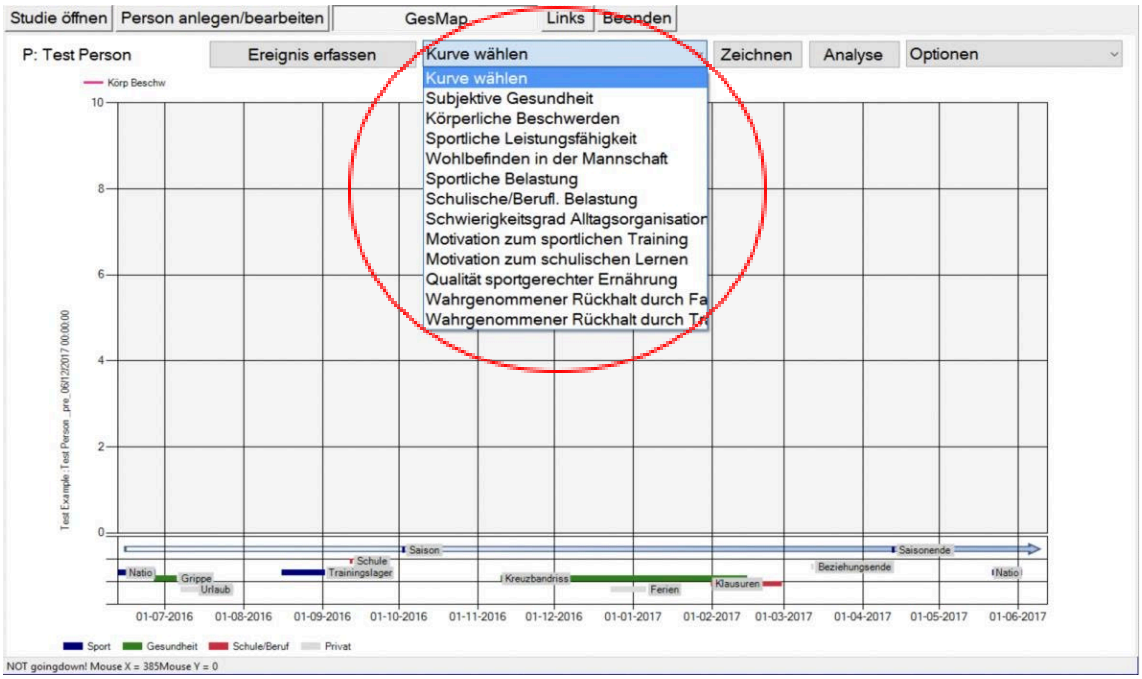

Figure 16: Selection of the curve to be drawn

To draw, the button *Draw [Zeichnen],* which is highlighted in green after curve selection, must be operated by clicking on the button. If the button is highlighted in red, you can draw. In addition, the interviewees are asked to reflect on the drawn curves. This reflection should be encouraged while drawing the curves in the form of “thinking-aloud”. However, if participants are overwhelmed and prefer to draw the curve first, it is the task of the interviewer to encourage reflection on the curve course afterwards by asking for explanations of highs and lows (see Fig. 17).

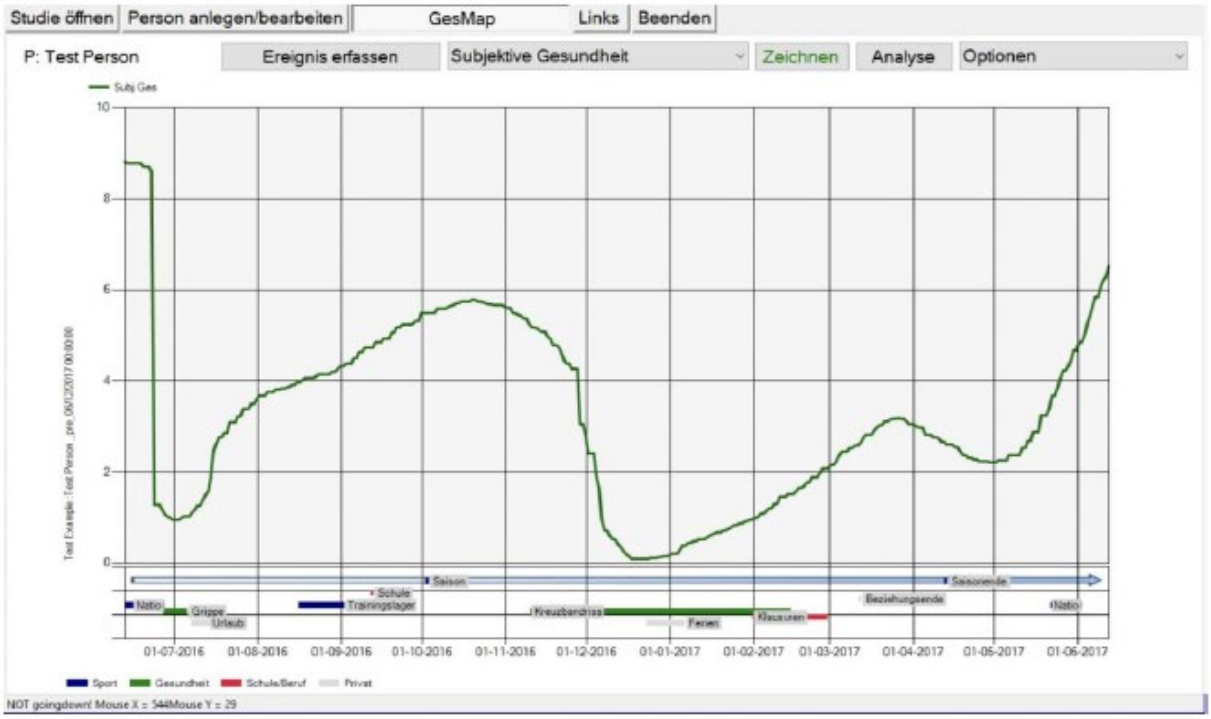

Figure 17: Exemplary curve course of the dimension “subjective health“

Repeating this step several times allows to collect all predefined curves in the given (or also another) order.

Step 7: Complete the assessment

Before finalizing the mapping, it should be verified that all relevant events and curves have been recorded. The *Options [Optionen]* button opens a drop-down menu, which contains the export functions and also the option *Finalize the mapping [Map finalisieren]* (see Fig. 18). If one aims to finalize the mapping of the respective person, this step must be approved in a confirmation field. Subsequent editing of the curves and events is then no longer possible.

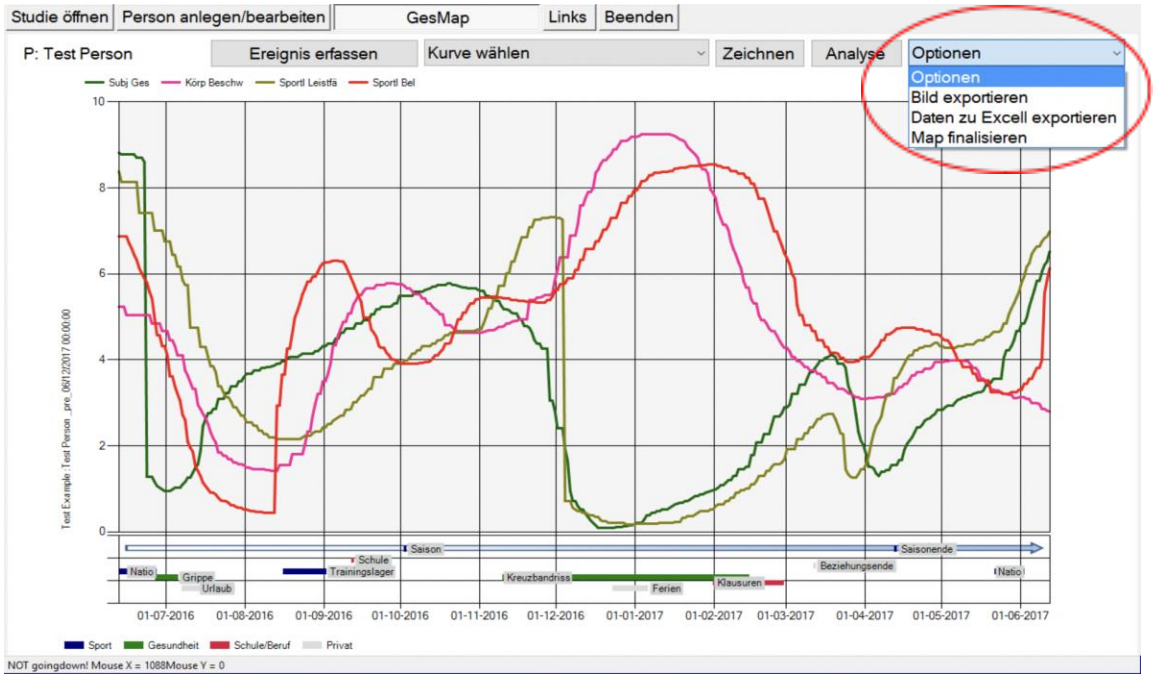

Figure 18: Options - Finalize map

Step 8: Analyze curves

The *Analysis [Analyse]* button allows to qualitatively analyze the collected data directly in the software. Curves can be selected and analyzed in relation to each other (e.g. parallel or opposite curves) and to biographical events (e.g. maxima and minima) (see Figs. 19 and 20).

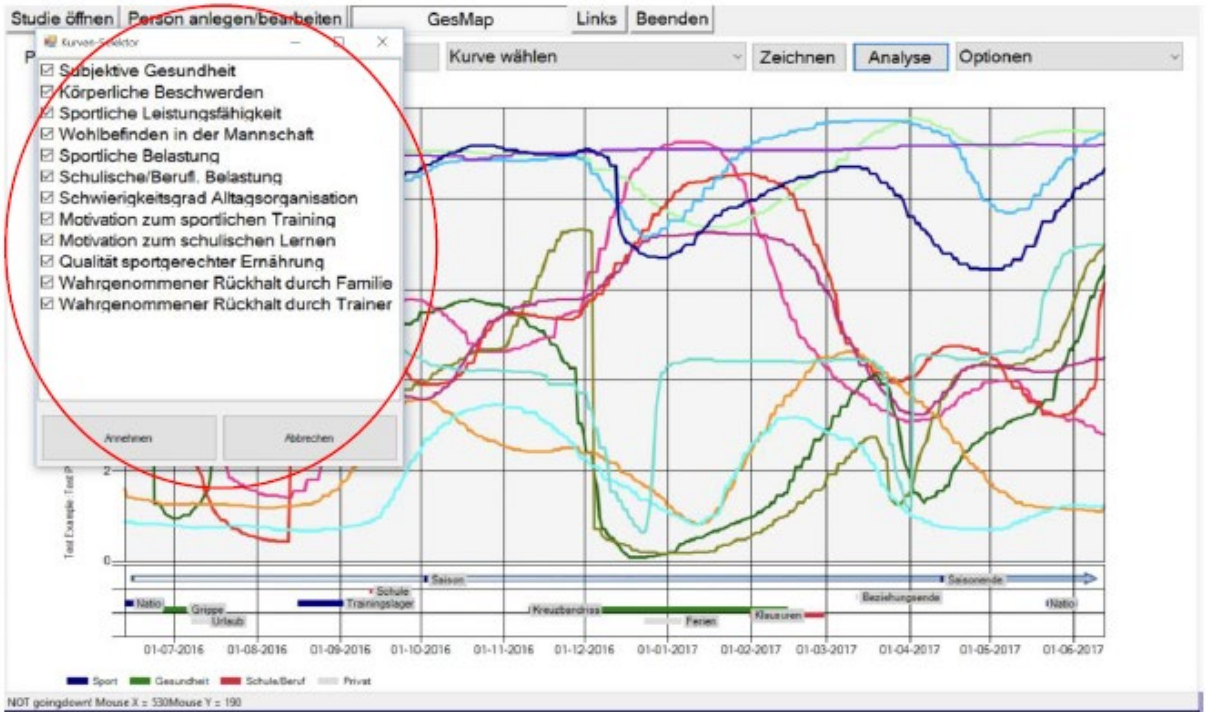

Figure 19: Analysis - Selection of curves

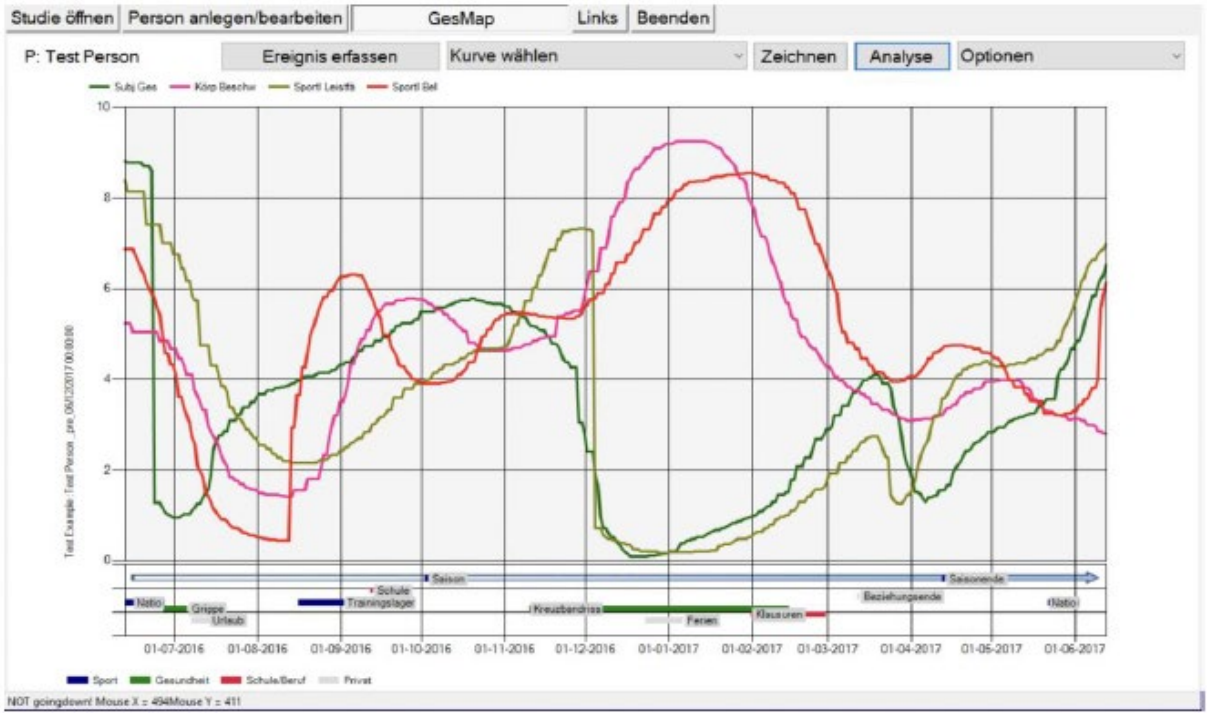

Figure 20: Analysis - Comparison of four curves and their relation to biographical events

Step 9: Export results

In addition, the results can be exported. Via the *Options [Optionen]* button, the mapping can be exported as a jpg image file (menu item *Export image [Bild exportieren])* and as an Excel file (menu item *Export data to Excel [Daten zu Excell exportieren]).* A new file is created in the study folder, which is based on the name of the person (depicted at the left of the coordinate system in the case of image export) and on the name of the study in the case of an Excel export (see Fig. 21).

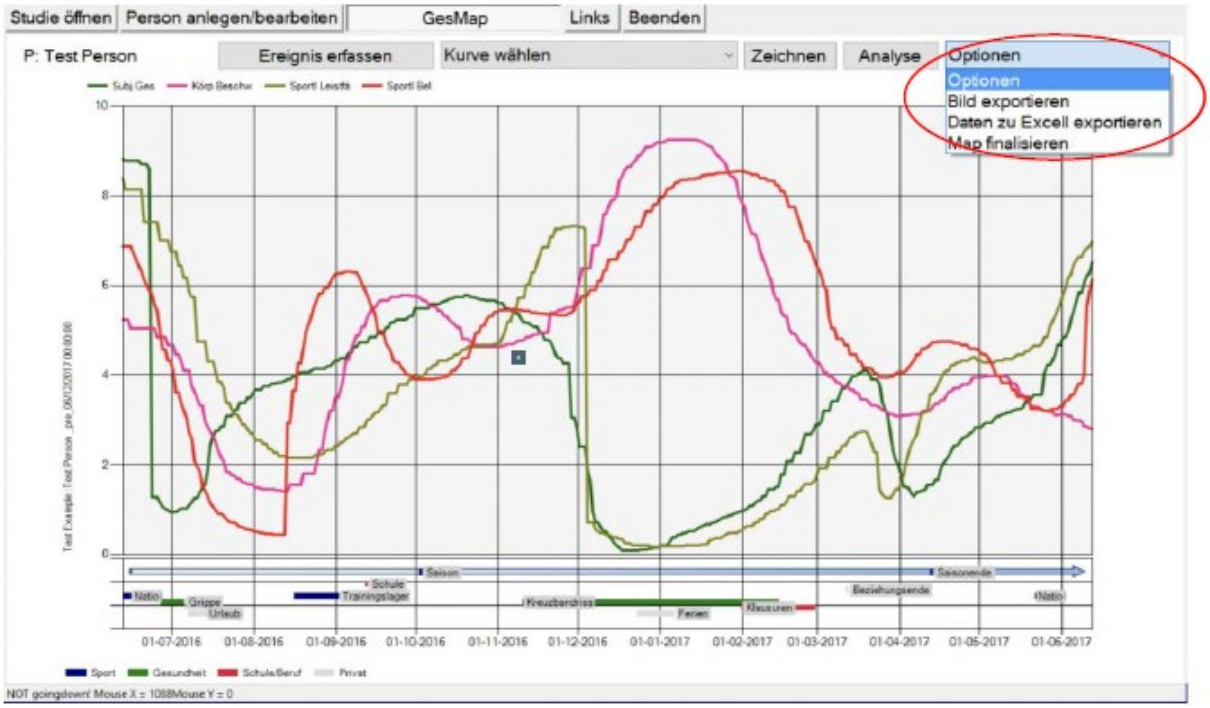

Figure 21: Export options as image or Excel file

3.3 Analysis Options

In addition to the software development, a theoretical framework for the interpretation of the biographical mapping data was developed during the project. This framework is based on the salutogenetic health model and can be used as an explanatory model for analysis in research as well as a model for data interpretation in the everyday practice of elite sports.

3.3.1 Adaptation of the Salutogenesis Model

The salutogenesis model by Aaron Antonovsky is a prospective approach to maintaining and promoting health. The salutogenetic model marks a paradigm shift in that it focuses on health rather than on disease. This is based on a new understanding of health. While pathogenetic models consider disease as an exception and health as the normal case, Antonovsky assumes "that the human system (as all living systems) is inherently flawed, subject to unavoidable entropic processes and unavoidable final death" (Antonovsky, 1996, p. 13).

The inherent tendency in human nature towards entropy and (biological) decay represents the axiom of salutogenesis. Thus, Antonovsky dissolves the dichotomy between healthy and sick and includes all humans irrespective of their health condition in his model. Based on the assumption that some people are healthier than others, people are located at different points on a 'multidimensional health continuum' (Faltermaier, 2005). This continuum depicts the individual's state of health between the two poles *Ease* and *Dis-Ease* (Mittelmark & Bull, 2013). The continuum is believed to be multidimensional because health is a highly complex phenomenon influenced by

various factors: "All human distress is always that of an integrated organism, always has a psychic (and a social (...)) and a somatic aspect" (Antonovsky, 1996, p. 11). Herewith, the model of salutogenesis follows Engel's biopsychosocial understanding of health (1979), which points out that illness is more than just a biochemical deviation and that, among other things, individual living conditions have a considerable influence on the state of health (cf. Faltermaier, 2005, pp. 48-49).

These assumptions are reflected in Antonovsky's salutogenetic model. The central building blocks of his conception are the socio-cultural and historical context in which an individual lives his or her life, the individual biography developed within this context, existing (psychosocial and genetic-constitutional) resistance resources, potential (psychosocial and physical and biochemical) stressors, as well as an individually distinctive sense of coherence (see Fig. 22).

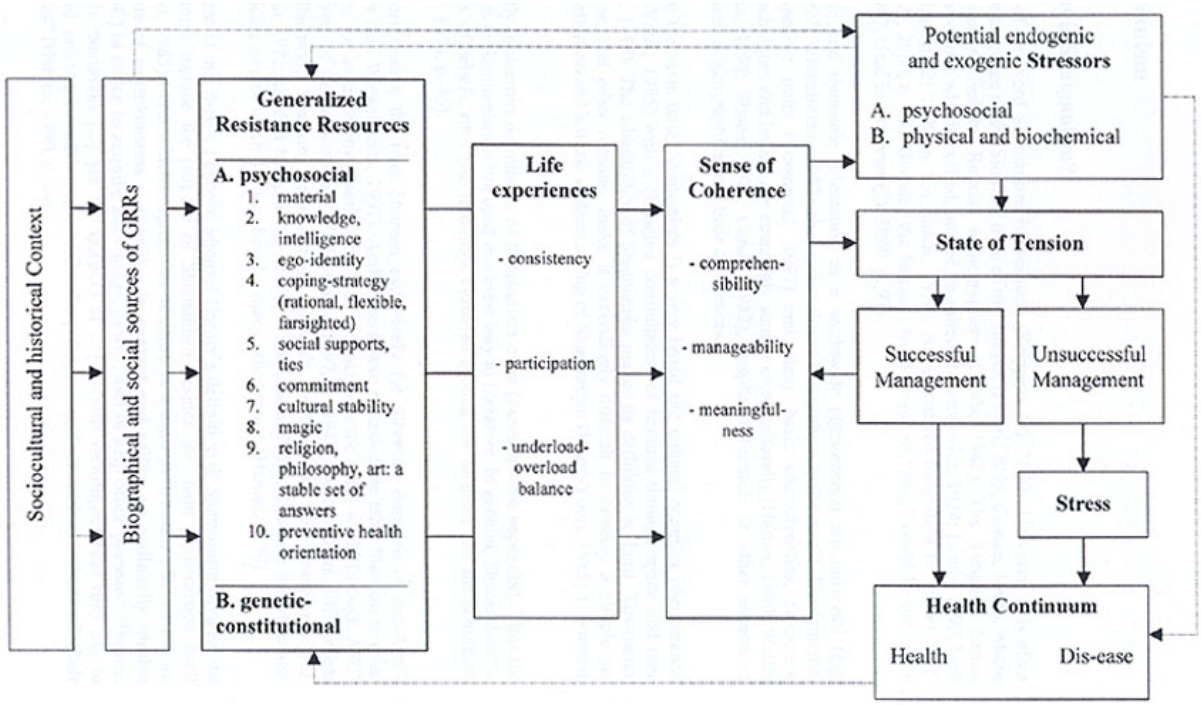

Figure 22: Model of salutogenesis according to Antonovsky (taken from Faltermaier, 2005, p. 66)

The negotiation process between stressors and resistance resources is conceptualized as the essential mechanism within the model. This negotiation process results in a state of tension with which the individual has to cope. Influenced by the interactions and feedback loops of the single dimensions (resources, stressors, sense of coherence, etc.), individual coping strategies are more or less successful and thus determine the individual's location on the health continuum (more towards health or more towards illness).

The following considerations and modifications are based on the framework offered by the salutogenesis model. Our aim was to develop a theoretical model for the analysis and interpretation of the biopsychosocial health trajectories of young competitive athletes assessed with the bioMAP program. The curves defined within this project (cf. Chapter 2.4.1, Tab. 7) are at the core of our considerations. For the purpose of analysis, the curves can be assigned to the three concepts of the *health*

continuum, stressors, and resistance resources within the salutogenetic model. Based on these considerations, we developed the following model (see Fig. 23).

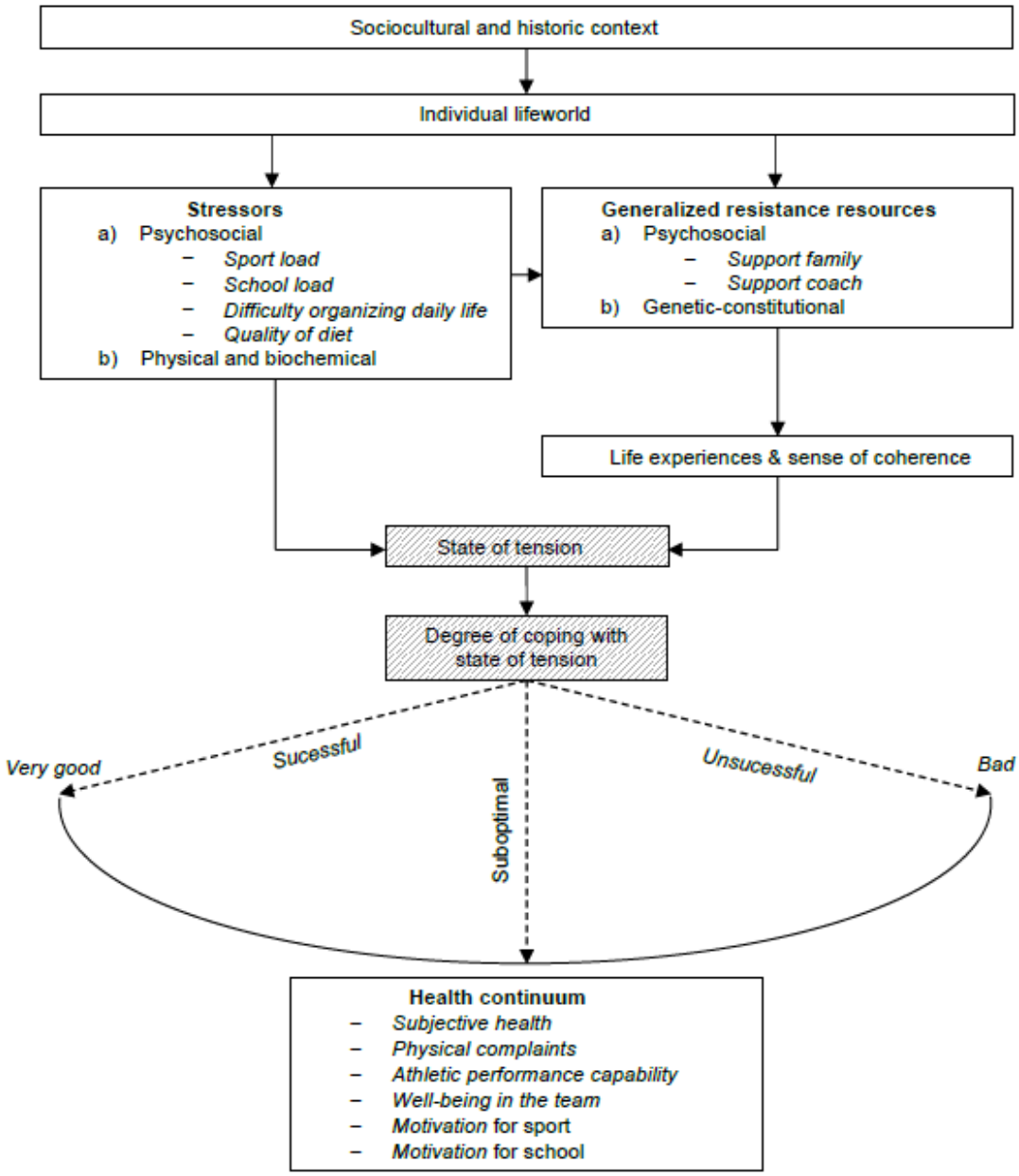

Figure 23: Modified salutogenesis model for the analysis of biographical mapping data

Competitive athletes operate in a socio-cultural context in which health is the central prerequisite for success. Accordingly, it is the goal of athletes to successfully overcome states of tension and to position themselves as far to the left on the health continuum as possible. Using the bioMAP method, it is now possible to identify the characteristics athletes exhibit in several biopsychosocial health indicators (subjective health, physical complaints, athletic performance capability, well-being in the team, motivation for sport, motivation for school) over a certain period of time. Furthermore, the general health situation can be assessed. The bioMAP method already uses an intensity scale (from 0 to 10) that allows to locate the health-related parameters on a continuum, which makes the method compatible with the salutogenesis model. The

variables that we summarized under the health continuum basically correspond to a multidimensional understanding of health, which, following the underlying idea of the mapping method, is based on a subjective perspective.

In addition, information on the development of potential (psychosocial) stressors and resistance resources can be obtained from the curve courses defined in Chapter 2.4.1. In the context of elite sport, there is a multitude of possible stressors with which (especially young) athletes are confronted. These include mainly stressors in sports, school, and private life. Stressors can occur as a result of significant 'objective' (with regard to the life course) or subjectively relevant (with regard to the biography) life events. In the bioMAP, these data can be collected on the time axis (x-axis). When drawing the curves, the athletes interpret the recorded events with regard to their significance for the respective health-related parameter. Curves that represent the trajectory of potential stressors are the following: sport load, school load, difficulty of organizing daily life, and the quality of the diet. These stressors can be located at the psychosocial level.

Beside stressors, the resources that athletes have in their everyday lives and that support them when coping with stressors play an important role. These resources include the perceived support by the family and the perceived support by the coach. These variables, as well as the variables mentioned above, were determined based on the results of the expert workshops, and are located at the psychosocial level of resistance resources.

We have not yet explained the state of tension, which results from the interaction of stressors and resources, and the coping response. The state of tension itself and the corresponding coping response cannot be captured with pre-determined curve courses. Thus, they represent the black box of the presented model (depicted in grey in the model). Nevertheless, the data on the health continuum, the stressors, and the resources can provide meaningful information on the health status of athletes, offering starting points for individualized training and health management.

In the following, we present an analysis procedure based on the described model that allows a structured and theory-based interpretation of the bioMAP data.

3.3.2 Analysis and Interpretation in Four Steps

The modified salutogenesis model allows the stepwise analysis of data from the bioMAP assessment. Information on the development of the biopsychosocial health status of athletes can be obtained, which in turn is relevant for the individualized health and training management through coaches and caregivers. The procedure proposed in the following describes the individual steps of analysis. This is not yet a validated procedure. Rather, the four steps (as well as the proposed typification on the basis of the health indicators "subjective health", "physical complaints" and "athletic performance capability") were generated through an initial analysis of the data collected in the beta test and require further sound analyses in the long-term. Nevertheless, the proposed procedure offers a way to get familiar with the collected data material.

Step 1: Assess the development of health indicators

In order to organize and structure the initially confusing data material, it is proposed to first take a closer look at the development of the health indicators. However, even then, it is still necessary to further reduce complexity and not include all six variables (subjective health, physical complaints, athletic performance capability, well-being in the team, motivation for sport, and motivation for school). We recommend to first look at the three most global curves in order to further reduce complexity. In our opinion, in a sports system in which only "the efficient body" counts (Bette & Schimank, 1995, p. 44), these are the trajectories of the following variables: subjective health, physical complaints, and athletic performance capability.

On this basis, five exemplary 'health types' can be identified, taking into account relevant biographical events recorded on the time axis.

Type I: Moderate health restrictions

Athletes with moderate health restrictions barely miss any play time and report only very few (if any) health events (illness, injury, etc.). Overall, the curves show no extreme ups and downs and only moderate changes. If a higher curve deflection occurs, it appears punctually and briefly and can usually be attributed to a specific event. It is also noticeable that the curves "subjective health" and "athletic performance capability" run predominantly in parallel and in the upper third of the coordinate system. The "physical complaints" curve, on the other hand, is largely in the lower third, although the athletes almost never claim to be completely free of complaints. With regard to the curves "physical complaints" and "subjective health" there is almost no overlap and an increase in complaints is often only linked to sporting events (training camps, competitions etc.).

Type II: Successfully managed health crisis

For athletes assigned to the successfully managed health crisis type, the duration of the reported health events varies between one and four months. Overall, the curves are largely comparable with those of the previously defined type *moderate health restrictions*, but are characterized by a uniquely high severity of "physical complaints" with a simultaneous decrease in at least one of the two curves "subjective health" or "athletic performance capability". In most cases, an opposite course of physical complaints and subjective health/athletic performance capability can be observed. If physical complaints are indicated in a curve, these are usually linked to an illness or injury depicted on the time axis. Athletes of this type successfully coped with a health crisis. This can be observed with regard to the health indicator "physical complaints". After a period with increased complaints, a decline to a moderate level of complaints occurs. There is a slight tendency for the “subjective health” curve to decline even before the athlete's athletic performance capability drops, which means that the subjective health state is already lower in the run-up to a health event. In addition, overuse complaints (e.g. thigh or back problems) already become apparent in advance through a decline in the "subjective health" curve.

Type III: Acute health restrictions

Athletes with acute health restrictions tend to experience an increased degree of physical complaints at the time of the assessment. This type is characterized by an opposite development of the "subjective health" and "athletic performance capability" curves. In the run-up to the current situation, there are no clearly demarcated health-related events and with regard to the current curve characteristics, a clear event that would justify this deviation is not always apparent.

Type IV: Recurrent health restrictions

The type “recurrent health restrictions” is characterized by at least two phases with significantly increased levels of physical complaints (above medium level) and often a simultaneous reduction in the parameters "subjective health" and/or "athletic performance capability". If the athletic performance capability is reduced, usually the “subjective health” curve also shows reduced values. Both curves generally run contrary to the "physical complaints" curve. The deflections of all curves can usually be attributed to health events. Before and after a health event the curves return to the respective baseline level, which is different to the type “persistent/permanent health restriction” where this is not the case. The return to the baseline level is indicative of a good recovery after a health event. In particular, the parameters "subjective health" and "athletic performance capability" occasionally show time shifts in their trajectories, which are often linked to individual events and cannot be clearly explained.

Type V: Persistent/permanent health restrictions

Athletes with persistent/permanent health restrictions generally report many health events. Usually, they either report on one severe health event or a high number of minor health events with a high degree of complaint. In contrast to the type "recurrent health events", these physical complaints last for significantly longer periods of time and the values of the curves “subjective health” and “athletic performance capability” remain quite low. The curves have many ups and downs and barely remain at one level. Overall, all three curves ("subjective health", "physical complaints" and "athletic performance capability") are at a medium level. After a health event with a high level of symptoms, the values usually do not return to the initial pre-event level. This suggests that these athletes did not fully recover during the season. At times, the curves "physical complaints" and "subjective health" or "athletic performance capability" show an opposing development, whereby the curve "physical complaints" often runs above the other two curves.

Based on this first classification, the other health indicators ("well-being in the team", "motivation for sport" and "motivation for school") can also be considered. These can also be located on a continuum and can vary between very well or badly depending on the degree to which the state of tension is overcome (successful, suboptimal, or unsuccessful). It should be noted that inter-individual differences can also occur in this respect, depending on the individual's initial situation. Thus, for example, the social indicator "well-being in the team" can have constantly high values among athletes who have been part of the team for some time, whereas new team members mostly

experience some changes in this parameter over the course of the season. In addition, the social well-being of athletes can also be affected by injuries if they feel that they cannot contribute to the team and sporting success due to an injury.

The health indicators "motivation for sport" and "motivation for school" can generally be traced back to biographical events. Motivation and commitment to sport are high when important sports events take place or when athletes experience a successful comeback after an injury induced break. The motivation for sport decreases when the athletic season comes to an end or during holidays. The motivation for school is usually higher when important exams or presentations are due or when the athlete cannot fully participate in training due to a previous injury. In contrast to the “motivation for sport” curve, the “motivation for school” curve experiences faster and deeper declines and tends to be less pronounced overall.

As already indicated in the description of the model in the previous subchapter, the location of the health indicators on the continuum is influenced by the degree of coping with the state of tension, which in turn arises from the complex interplay between the two dimensions "stressors" and "resources". In our model, the state of tension and the subsequent coping response represent the empirical black box and do not allow any conclusions to be drawn. However, information from the bioMAP can be used to derive statements on the characteristics of stressors and resources (for the assignment of the curves to the two dimensions, see Chapter 2.4.1, Table 7).

Step 2: Assess the progression of the stressor indicators

The psychosocial stressors that we assessed as part of the biographical mapping are "sport load", "school load", "difficulty of organizing daily life" and "quality of sport specific diet". The development of these stressors and their interaction with psychosocial resources might help explain certain health characteristics. Additionally, the experience of stressors can give the coach an idea about the athlete’s life circumstances and enables him or her to adjust and control the individual training load. If, for example, an athlete perceives an above-average level of sport load (e.g. in an inter-individual comparison), this could possibly be an indication of emerging health problems. In addition, a culmination of sporting, school, and/or private events can lead to excessive stress and thus influence the subjective health, athletic performance capability, physical complaints as well as motivation for school and sport.

Step 3: Assess the development of resource indicators

Psychosocial resources can help in coping productively with a higher degree of individual stressors. In our model, resources include the "perceived support from the family" and the "perceived support from the coach". Especially during difficult phases characterized by high stress, it is important for athletes to feel supported from their (direct) social environment. As far as family support is concerned, this rarely poses a problem. The perceived support from the coach is not always perceived as positive. This often seems to be linked to athletic performance and play time. Injured athletes who are unable to participate in team training and competitions or athletes who do not get much playing time due to a recovered injury may not feel supported by their coach.

Step 4: Assessing the overall situation and deriving intervention measures

Depending on the assessment of the overall situation, the curve courses can help identify two possible approaches for intervention. On the one hand, it is possible to infer measures directly from the curves if it is clear at which level of the model an intervention is necessary (i.e. at the level of stressors or resources). On the other hand, measures can also be inferred indirectly from the curves. In this regard, the curves offer first insights, which, however, must be augmented by additional tests. Here, questionnaires with validated scales (e.g. on personality, identity, burn-out, nutrition, etc.) or individual coach-athlete conversations can make a significant contribution.

At this point it should be emphasized once again that the proposed model and the analysis steps (especially with regard to the analysis of the individual curve courses) do not describe a validated procedure. Rather, they serve as a first orientation point clarifying the potential of the biographical mapping approach. Additionally, they help in structuring the data material. In the future, it will be necessary to collect more data and analyze it both qualitatively and quantitatively.

Finally, it can be summarized that the salutogenetic model provides a framework for interpretation that can be used both in practice and in research. The advantage of the theoretical framework lies in its potential to identify the reasons (at the level of psychosocial "stressors" and "resources") for positive or negative health-related developments. As it is the case with every model, the model is an abstraction with a simplifying perspective. Nevertheless, it takes the complexity of health-related developments into account by integrating the social context and subjective life experiences.

4 Conclusion and Outlook

With the conclusion of the service project *Development of an instrument for the retrospective analysis of biopsychosocial health trajectories of young elite athletes (bioMAP),* it can be stated that the goals set in advance were more than achieved. On the one hand, the bioMAP software was successfully developed and tested. Each of the three described project phases was characterized by an intensive mutual exchange with representatives from elite sports, which ensured a high level of acceptance of the software among coaches and athletes. In addition, we collected data during the field test of the beta version, which allowed an initial categorization of the mapping results after preliminary analyses (cf. chapter 3.3.2). The latter can support coaches in identifying typical health trajectories (moderate, acute, recurring, or persistent restrictions) and, if necessary, in deriving intervention measures.

From a scientific perspective, it will be necessary to analyze the collected data in more detail and to examine how the individual health-related trajectories interact with each other. The proposed four-step analysis procedure needs to be specified further; the categorized health types need to be differentiated further. An additional challenge when conducting studies with larger sample sizes is the development of further analytical methods that also allow a quantitative analysis. With the Excel export function, which also allows data transfer to the SPSS statistics program, an important foundation has already been laid. Finding analytical methods for the identification of typical patterns and trajectories has a high relevance. The integration of an alert

function into the bioMAP software for critical or risky health trajectories would be of great help for coaches when designing training measures.

New application and analysis scenarios for elite sports practice have also emerged during the development of the bioMAP. For example, both athletes and coaches emphasize the need for an inter-individual comparison of health trajectories. So far, however, such a comparison can only be done by creating corresponding Excel tables, which is quite time consuming. In order to directly compare health trajectories between individuals, the bioMAP software should be augmented by a corresponding analysis feature. Such a function could also be used to compare the coach's subjective assessments (by drawing the progression curves for an athlete from the coach's perspective) with those of the athlete, and thus uncover possible discrepancies.

Also with regard to the frequency of application, further scenarios (in addition to those we have defined) should be considered. Athletes would prefer shorter intervals between the data collection points. Such a close monitoring could help identify critical developments even earlier, which would allow earlier intervention efforts. Additionally, athletes voiced the idea of a kind of “athlete’s diary”. Since the feedback on the method was almost entirely positive and almost all interviewed athletes stated that they were confident enough to complete a biographical mapping independently and without guidance, this represents an application scenario that has not yet been considered from a scientific perspective. Athletes are interested in reflecting critically on themselves and their careers, especially when they are confronted with road blocks and problems on their way to the top. However, it remains to be examined whether the bioMAP method has the same added value when completed by the athlete him- or herself as compared to an interview-based assessment.

The bioMAP software has proved to be an instrument that offers added value for both coaches and athletes and that allows a direct collection and analysis of data. The assessment is still relatively time-consuming and takes between 30 and 60 minutes, depending on the number of examined curves. Nevertheless, we expect that the biographical mapping approach with the bioMAP software has considerable potential for new and additional insights, particularly if used for extensive coach-athlete discussions. Especially when dealing with new athletes, coaches are able to collect a lot of information in a condensed form, which would otherwise only be detected slowly or not at all. bioMAP also supports young and less experienced coaches in the individualized design of training and health management strategies for young athletes.

An implementation of bioMAP into everyday training practice should be made possible in the near future. The prerequisites were created through the development and testing of the software, as well as through the close cooperation with our project partner, the VC Olympia Berlin. In the medium to long term, we can imagine that the software can be disseminated in other training contexts of the German Volleyball association, and also in other leading athletic associations as a best practice model. In order to achieve this, however, further research and development work in close contact with elite sports practice will be necessary.

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5.8 Article 7: "All roads lead to Rome? Talent narratives of elite athletes, musicians, and mathematicians"

John, J.M. & Thiel, A. (in revision). All roads lead to Rome? Talent narratives of elite athletes, musicians, and mathematicians. *Qualitative Research in Sport, Exercise and Health*.

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All Roads lead to Rome? Talent Narratives of Elite Athletes, Musicians, and Mathematicians

On the surface, careers of high-achieving individuals follow a clear and linear pattern: Talent detection, talent promotion, talent development in specialised settings, success in competitions etc. A closer look at career trajectories of high-achievers, however, suggests that the paths to the top level are much more diverse than the public assumes. To understand how talent develops over time and how notions about talent and giftedness impact the retrospective construction of high-achievers' own development, it is important to gain an insight view.

With the current paper, we therefore aim to examine the life story accounts of high-achieving individuals from the achievement domains of sports, music, and mathematics. A central question in this regard is whether talent stories on developmental pathways are characterised by domain-specific cultural ideas about talent and giftedness, or whether the stories share similar thematic and structural features that can be observed across domains.

In total, we interviewed ten elite athletes, ten professional musicians, and ten mathematicians. For analysis, we employed a within-case thematic analysis and a narrative analysis of structure and form.

Overall, we identified five different types of talent narratives on developmental pathways, namely searching for the spotlight, straightforward career, overcoming obstacles, riding the waves, and applying effort. Each type of narrative is characterised by a specific structure and content, and can be observed across performance domains. Thereby, individual talent stories are structurally coupled to broader narratives about talent and giftedness that seem to operate independently of the respective achievement domain.

Keywords: talent development; narrative; life story; giftedness; talent; elite sports; music; mathematics; high-achiever

Introduction

In the common public understanding of talent, mostly three domains are mentioned: sports, music, and mathematics. Anecdotal accounts about world-class athletes, musicians, and mathematicians often include notions of the precocious, highly gifted or talented child. These notions likely influence perceptions of talent and giftedness at both an individual and societal level, as Carless and Douglas (2013) exemplify for athletes: 'Athletes inhabit a culture awash with public stories relating to (preferred) identities, (expected) behaviors, and (assumed) developmental trajectories' (702). On the surface, the development of high-achievers in different domains follows a clear and linear pattern, and can be described 'as a process of talent development in which a person's potential for achievement develops into actual achievement' (Preckel et al. 2020, 692). A closer look at developmental trajectories of high-achievers, however, suggests that the paths to the top level are often much more diverse than the public assumes (Phillips et al. 2010).

In modern society, life courses are not strictly predestined; rather the principle openness of life courses makes it possible – but also requires individuals – to decide independently whether to follow one's predispositions and penchants (Thiel and Gropper 2017). For the individual, 'the perceptions of giftedness as well as perceptions of oneself as gifted (however giftedness is conceived) are critical factors that influence one's course of achievement' (Fahlman 2004, 288). However, the attribution of talent or giftedness to a person does not mean that this person will automatically follow the respective career path or predetermines, if he or she does, how the path will look like.

To understand how talent develops over time and how notions about talent and giftedness impact the retrospective construction of high-achievers' own development, it is important to gain an insight view. In this regard, the stories individuals tell about their lives are particularly interesting. With the current paper, we therefore aim to examine the life story

accounts of high-achieving individuals. To analyse whether there are relevant differences in talent narratives between individual talent domains, we examine the three areas where success is most strongly associated with giftedness: sports, music, and mathematics (Subotnik, Olszewski-Kubilius, and Worrell 2011). A central question in this regard is whether talent stories on developmental trajectories are characterised by domain-specific cultural ideas about talent and giftedness or whether the stories share similar thematic and structural features that can be observed across domains.

Life Stories, Narratives, and Radical Constructivism – Theoretical Assumptions

For examining how individuals craft their own personal stories of talent, success, and achievement, narrative approaches are the methods of choice (Cohen, Duberley, and Mallon 2004; Carless and Douglas 2013). Narrative research focuses on meaning making over time in the context of an individual's life. Therefore, narrative researchers often employ a life story approach to elicit the grand stories about a person's life (McAdams 2001; Riessman 2001), in which life events and contextual factors are integrated in a meaningful and mostly coherent way.

When storytellers reflect on own experiences and craft personal stories about their lives, they are never completely detached from the socio-historical and cultural context they live in (Smith and Sparkes 2009a). Even though every life is unique, the life stories individuals tell often mirror culturally accepted storylines. Narrative researchers use terms such as cultural narratives, meta-narratives, or master narratives to denote the sociocultural embeddedness of stories. Master narratives impact the themes narrated in personal stories; they shape the storyteller's *and* listener's perception of the appropriate timing of life events and their sequential order (McLean and Syed 2015). Master narratives also affect stories at a structural level (i.e. how the story is put together). In this regard, the dominant narrative in Western culture is the redemption narrative (McAdams 2013, 2001) – a narrative moving

from adversity to triumph. Taken together, individuals tell specific stories about their lives, but not narratives. Rather, narratives are 'the background form or template that stories rely on' (Ronkainen and Ryba 2019, 549).

Stories are contingent constructions of reality, meaning that a story could also be told in a different manner and still represent the individual's own construction of his or her reality. Applying Maturana and Varela's (1992) ideas of radical constructivism to life stories and narratives leads us to the following theoretical assumptions: The individual story is structurally coupled to master narratives, which, however, are located at a different systemic level and do not predetermine but rather shape the construction of the personal story. From the perspective of radical constructivism, the storyteller processes experiences and master narratives in the respective lifeworld in a self-referential manner according to his or her own biographical logic (cf. Schimank 1988), meaning that experiences and master narratives gain significance for the personal life story against the background of previous experiences. Analytically, personal life stories can only give insights into the storytellers' own constructions of past, present, and anticipated future. However, the comparative analysis of multiple individual life stories allows researchers to identify similar patterns across stories and build a typology of stories that share certain properties such as structures, contents, tell-ability, and consequences (Frank 2013). This typology of stories can be understood as an approximation of master narratives.

The Relevance of Life Stories and Narratives for Talent Development

Narrative approaches within the context of talent and career development research are still rare, but have become increasingly popular within sport and exercise psychology over the last years (Ronkainen, Kavoura, and Ryba 2016; Smith and Sparkes 2009a). Douglas and Carless (2006) and Carless and Douglas (2012) analysed success stories of professional athletes and how these stories are embedded into the wider sociocultural context. Based on a thematic and

structural narrative analysis of interviews with female elite athletes, Douglas and Carless (2006) developed a widely used typology of success narratives in elite sports. According to their analysis, elite athletes most often story their lives in terms of a performance narrative, whereas other narrative types, such as the discovery or relational narrative, are less frequently used by athletes to construct their life stories. Despite the widespread use of this typology, Ronkainen, Kavoura, and Ryba (2016) voice the sentiment that trying to fit athletes' stories into these pre-determined categories might omit other stories; thus, they emphasise the need to stay flexible and seek to expand the typology.

By analysing personal talent stories, researchers can generate knowledge about how successful individuals narrate their development while at the same time considering their specific life worlds (cf. Phoenix and Smith 2011). At first glance, the three achievement domains we examine appear to be quite dissimilar: sport is affiliated with the body, music with arts, and mathematics with academic and intellectual pursuits. Thus, the life worlds of athletes, musicians, and mathematicians also seem to differ and be characterised by specific norms and values, attributions, and experiences. However, studies about barriers and facilitators on the path to excellence also show similarities across these different domains (Beltman and Volet 2007; MacNamara, Button, and Collins 2010). Overall, high performance sports are characterised by a *culture of risk*, in which it is socially expected and encouraged to disregard and hide pain for the sake of athletic achievement (Nixon 1993; Mayer et al. 2018). The so-called *culture of risk* and associated individual health-risks behaviours, however, can also be observed in music (John, Gropper, and Thiel 2019), and to a certain extent also in academics with its highly selective system that encourages extremely long working hours with potential negative health consequences such as burnout (Jaremka et al. 2020). Thus, the respective life worlds of athletes, musicians, and mathematicians offer

socially shared ideas not only with regard to what it means to be talented, but also how the talented individual is expected to act within a specific achievement context.

Therewith, personal talent stories can provide insights into the intrinsic, non-linear dynamics of talent and career development as experienced and then storied by the performer him- or herself against the background of master narratives about talent and giftedness. At a personal level, the stories individuals tell about their lives *act* on the individuals *themselves* (Frank 2010); they shape the opportunities for the storytellers' further development affecting their lives in positive and/or negative ways. At a societal level, personal talent stories also have an impact *beyond* the high-achievers themselves; in the words of Frank (2010), stories also *act* on *others*. Societal ideas about the nature of talent and giftedness – that are themselves at least partly informed by the personal accounts of high-achievers – are the basis of support measures, starting with didactic concepts for the promotion of special skills up to mentorship programs. Often, current high-achievers serve as mentors or role models; thereby, they pass their own stories about what it means to be talented or gifted to younger generations. In this sense, they offer storylines on which upcoming talents can build their own stories, which in turn reinforces master narratives about talent and giftedness. The stories of current high-achievers about their development may also shape the career planning of aspiring athletes, musicians, or mathematicians, and their ideas of how their future might unfold and which choices and experiences appear to be beneficial for their development (Ronkainen and Ryba 2019).

Purpose of the Study

The current study intends to explore the talent stories of high-achieving individuals from three different achievement domains. In this regard, our aims are twofold. First, we aim to examine how high-achieving individuals narrate their developmental pathways. Second, we

aim to identify cultural ideas about talent and giftedness in the individual stories and how these ideas impact the retrospective construction of the developmental pathway.

Narrative research on developmental pathways has only been conducted within elite sports (e.g., Douglas and Carless 2006; Carless and Douglas 2012; Ronkainen and Ryba 2019), but not in non-sportive achievement domains, such as music or academics. By comparing the stories of elite athletes with those of high-achieving musicians and mathematicians, we hope to discover new aspects of talent narratives that might have been overlooked in research so far.

Method

We work with an interpretive paradigm because we aim to understand and highlight human experience and its meaning for the individual (Carless and Douglas 2013). In our understanding, knowledge is socially constructed, and therefore, with our work, we intend to open up conversation and debate rather than attempt to discover universal truths (Carless and Douglas 2013; McLeod 1997). Within an interpretive paradigm, the current study is underpinned by epistemological constructivism. We conceptualise human beings as meaning-makers who use stories to interpret and communicate their lives and to configure and constitute their experiences (McAdams 2008). Even though stories may be very personal, they do not emerge in a vacuum; instead, they are influenced by the cultural master narratives that surround the storytellers (McLean and Syed 2015; Smith 2016).

Researcher Positioning

A constructivist perspective necessitates that close attention is given to the researcher's own positioning within the research process. The data generated by participants and the knowledge generated by the researcher are inevitably shaped by the researcher's own lived experiences (Lincoln, Lynham, and Guba 2011). The lead author who conducted all life story interviews is a former elite athlete, which facilitated access to the athlete subgroup of the

current study. Additionally, the lead author is a former member of the German Academic Scholarship Foundation (Studienstiftung des deutschen Volkes), Germany's largest and oldest sponsorship organisation for the academically gifted. Some musicians and mathematicians were members of this organisation during their studies; thus, the author's membership facilitated access to these two subgroups. The interviewer's own experiences in an academic and athletic high-achievement context allowed the first author to combine the scholarly curiosity of a narrative researcher with an empathic stance towards participants' experiences. We felt that the lead author's own experiences facilitated trust and rapport and increased participants' openness. However, to increase methodological rigour, it was essential to keep a reflective diary throughout the research process and to have regular meetings with critical friends to challenge assumptions that might have been influenced by the lead researcher's own life experiences (Smith and Sparkes 2009b; Smith and McGannon 2017).

Participants and Procedure

We employed a purposive sampling approach to achieve a balanced sample with regard to gender and age in an attempt to reflect the broad spectrum of expert performers ranging from upcoming talents to more established, senior high-achievers. Since we aimed to examine only current high-achievers, we had to recruit participants of different ages due to the different ages at peak performance in the achievement domains of music, mathematics, and sports (Subotnik, Olszewski-Kubilius, and Worrell 2011).

We operationalised giftedness on the basis of adult success (Olszewski-Kubilius and Thomson 2015; Fahlman 2004; Subotnik, Arnold, and Noble 1995), which corresponds to the study's focus on current adult high-achievers. To be included in the study, (a) athletes had to compete at least at the national level or had to be members of the national team; (b) musicians had to be either outstanding students selected by well-known professors at

specialised music colleges based on their potential for a professional career, or professional classical or jazz musicians who make their living with music and/or play in leading (German) orchestras or big bands; (c) mathematicians had to be either outstanding college students selected by well-known senior professors based on exceptional success in their studies and successful participation in national math competitions, or internationally acclaimed junior professors, or tenured full professors. The final sample consisted of ten elite athletes (5 males, 5 females) with a mean age of 24.6 years (20 – 38 years of age), ten professional musicians (7 males, 3 females) with a mean age of 33.2 years (19 – 47 years of age), and ten mathematicians (7 males, 3 females) with a mean age of 37 years (20 – 49 years of age).

The ethics committee of the Faculty of Economic and Social Sciences at [name of university] granted ethical approval for the study (AZ.: A2.5.4-079_aa) and all participants signed informed consent forms after being fully briefed about the nature of the study and before commencing the interviews. The first author conducted all 30 interviews in Germany and Austria between December 17, 2018 and December 17, 2019. The face-to-face interviews took place either at the participants' homes or offices, or at the lead author's workplace in a quiet room at times convenient to the participants. Interviews lasted on average 94mins. All interviews were recorded and transcribed verbatim by the lead researcher and trained student assistants yielding 935 single-spaced pages of transcripts.

For the interviews, we used the biographical mapping approach (for a more detailed description see Thiel et al., 2020). In the current paper, we only analyse the first part of the biographical mapping interview, in which we asked participants to reflect on critical life events and important periods for their personal and career development. This part of the interview closely resembles a life story interview. To guarantee anonymity to the participants, we used pseudonyms and deleted all identification information in the interviews. All

references to places such as universities, or placings at competitions in specific years have been eliminated.

Data Analysis

First, we immersed ourselves in the data through reading and re-reading the transcripts. Such a process of indwelling allows researchers to become deeply familiar with the data (Smith & Monforte, 2020). For analysis, we employed a within-case thematic analysis and a narrative analysis of structure and form.

The within-case thematic analysis (see Riessman 2008) allowed us to identify central themes within each individual story. We specifically focused on those parts of the personal stories where narrative tension arose. According to Carless and Douglas (2013) 'moments of narrative tension can provide insight into times when psychological and sociocultural factors interact or collide. These moments could (…) be when an individual's story of personal experience clashed with a cultural story operating around them' (703). This stage of analysis helped us identify topics and themes related to talent and giftedness within the story's overall content.

With a structural narrative analysis approach, story analysts focus on the story's overall sequential composition, in other words, how people's stories are put together (Smith 2016). In this regard, Sparkes (2005) argues that '[t]he formal aspects of structure, as much as content, express the identity, perceptions, and values of the storyteller' (195). We chose this analytical approach to focus on (a) whether high-achievers perceive and identify themselves as talented or gifted, (b) how they negotiate their own identity in relation to cultural perceptions and notions of talent and giftedness, and particularly (c) how this process plays out in narrating their developmental pathways. Such a focus can contribute to our understanding of how culturally available narratives about talent and giftedness informed each individual's construction of his or her personal life story.

After we had identified different types of talent narratives based on content, structure, and function of the respective stories (Smith 2016), we revisited our data to ensure that the developed typology of talent narratives is grounded in the actual participants' stories.

Results and Discussion

We decided to combine results and discussion to provide a more transparent and coherent connection between participants' stories and existing knowledge (Cavallerio, Wadey, and Wagstaff 2017). Overall, we identified five different types of talent narratives on developmental pathways, namely *searching for the spotlight*, *straightforward career*, *overcoming obstacles*, *riding the waves*, and *applying effort*. These types of narratives do not represent certain types of individuals, but rather should be read as types of storied talent development pathways. Each type of narrative is characterised by a specific structure and content, and can be observed across performance domains. Thus, the identified types of talent narratives are not specific to one achievement context, but rather seem to represent master narratives on developmental pathways that inform personal talent stories in the domains of sports, music, and mathematics.

In the following, we characterise and discuss each type of talent narrative with regard to the storied developmental pathway and notions of talent and giftedness within these accounts. Instead of presenting quotes from just one *typical* story for each narrative type, we elaborate on and present prototypical instances from different stories across the three achievement domains. This representational strategy has been used in several narrative studies (e.g., Busanich, McGannon, and Schinke 2016; Ronkainen and Ryba 2019). In line with our theoretical framing of stories and narratives, we assume that types of narratives built on the basis of a collection of individual stories are best presented and understood through a mode of presentation that allows different stories within each type to be heard (Lincoln and Denzin 1994). We also chose this mode of presentation due to our study's focus on three

different achievement domains. Therewith, we specifically aim to demonstrate (a) how the individual stories from different achievement domains share similar structural and thematic features (and thereby make up a specific type of talent narrative), and (b) how these individual stories are structurally coupled to broader narratives about talent and giftedness that seem to operate independently of the respective achievement domain.

Searching for the Spotlight

The *searching for the spotlight* narrative revolves around a deep need for attention, admiration, and acknowledgement through significant others, which is hoped to be satisfied through engagement in the specific achievement context. Mary, a trombone player and conductor, summarised her developmental pathway in the following words: 'For me, this is it. Yes, I am simply born for this job, where I take centre stage.'

In the beginning of the story, storytellers present themselves as someone 'special'. Susan, a track and field athlete, began her life story account with the following excerpt:

> Well, I am a twin. This might be something special about me. Already in my mother's womb, I have been a whirlwind. (…) Well, my time in kindergarten was a really nice time, as well. I always was the favourite child because I liked to clean up. Somehow, I have always known how to win power, eh, how to win others' favour. I have always been trying to be someone's favourite child in a way.

Already evident in the excerpt is her desire to be special and admired by others. Her account also shows that the feeling of being special and wanting to be recognised as such is not solely tied to the respective achievement context, but is important to storytellers in other domains of life such as at school, in the family, peer group, or romantic relationships. The idea of being normal seems to represent a negative concept (Cavallerio, Wadey, and Wagstaff 2017) for *searching for the spotlight* storytellers; the only way to feel worthy is by being admired through others.

Consequently, other individuals within the achievement context only play a role as either a person who has to be outperformed in the case of peers, or as a person who praises the storyteller in the case of mentors. Thus, interpersonal relationships appear to be very functionalised in the sense that others are needed to provide acknowledgement and admiration, which is not completely uncommon for high-achievers, particularly those scoring high on narcissistic personality traits (Douglas and Carless 2006; Roberts, Woodman, and Sedikides 2018). Mary offered the following account in which she recounted an incident in her school's orchestra in which she played with her father and sister:

> And then, one time early on, after an orchestra rehearsal my father told me, "whoa, this trumpeter, she plays absolutely well." And the ten- or eleven-year-old me thought: "Oh, I also want to become so good in music, that others say about me: Whoa, Mary, she plays extraordinarily well." Yes, simply this remark of my dad, which was probably meant quite casually. (…) But this remark awakened a huge ambition within me. According to the principle: I also want to gain this recognition. I also want that people somehow admire me. And, somehow, I want to work my way up to become a celebrity, to be in the spotlight.

Later in her life story, Mary referred to this incident again:

> Well, towards the end of high school, I was indeed where I wanted to be. I was at the same place as this trumpeter, that I got to know in our school's orchestra when I was eleven. (…) That was the point, when I was in the spotlight where I always wanted to be. (…) This has always been a tendency of mine, to be in the spotlight, at the centre of attention. This is something that I have always wanted. Also, working my way up so that people give me recognition for my achievements. I think this was also pivotal for my aspiration to become a musician. (…) I have always been driven by this hunger for recognition.

The story shared by Mary provides an illustration of how the thirst for self-enhancement, recognition, and admiration appears to be one of the underlying drivers of the developmental pathway. Storytellers seem to crave and need this approval through others to feel good about themselves; thereby, they display signs of a narcissistic personality style, which receives increasing attention in research on high performers (Roberts, Woodman, and Sedikides 2018). Despite the focus on others, the *searching for the spotlight* narrative differs from the

relational narrative described by Douglas and Carless (2006), in which being successful is storied as maintaining connection, cooperation, and community. Rather, the *searching for the spotlight* narrative relies on typical masculine traits within the performance discourse such as strength, independence, ambition, and competitiveness (Douglas and Carless 2006), and devalue communion and effective relationships (Roberts, Woodman, and Sedikides 2018).

The pursuit of admiration can be framed as the *organising principle* behind this type of talent narrative, even during setbacks. Susan recounted a poor performance at the world championships after which the media mocked her. When the lead author asked her during the interview how she felt about this incident, Susan replied:

> I have always wanted to become famous (…) And of course, my manager (…) said "Susan, what the fuck! What kind of shit have you/ How should I now make you attractive to potential partners? This is all shit. " (…) But then Raab [a well-known German television host; authors' own remark] invited me (…). Back then, he was still a legend. (…) And a lot of people watched his show.

Despite the hurtful comments in the television commentary, she storied the incident as another opportunity for being in the spotlight.

Searching for the spotlight storytellers seem to judge the importance of events for their developmental pathways in terms of their potential for public attention, and not so much in terms of positive or negative performance outcomes. Accordingly, events in which storytellers have the impression that they get lost in the crowd and are not in the spotlight are perceived very negatively, as can be seen in the following quote by Mary:

> Back then, I did not really enjoy playing in the youth orchestra. (…) I did not get the chance to position myself and present myself as a top player because the orchestra was quite large. I rather got kind of lost in the crowd.

Here, it becomes apparent that whether storytellers enjoy their engagement in the field (in this case playing in the youth orchestra) depends on whether the activity allows high-achievers to 'position' themselves and feel superior to others. In contrast, if the activity does

not offer the opportunity for personal glory, it is not experienced as intrinsically rewarding. In this regard, *searching for the spotlight* storytellers differ from gifted young females in the study of Fahlman (2004) who were uncomfortable with the implication of superiority in the concept of talent and giftedness. *Searching for the spotlight* storytellers overtly refer to their superiority in comparison to peers (such as having to practice less and still being better than their peers) and their desire for admiration. However, they are at the same time aware that their behaviours and attitudes towards others could be interpreted as being arrogant and condescending. But even if they try to avoid appearing arrogant, they voice that giftedness and talent constitute a duty on their part (i.e. fulfilling their potential) and that they have the right to be recognised by other people as the best within their domain and be treated accordingly (Mudrak 2011). Such attitudes and behaviours are not uncommon among gifted people in competitive settings who score high on narcissistic personality traits and have been interpreted as conducive to performance (Hardy et al. 2017; Roberts, Woodman, and Sedikides 2018; Wallace and Baumeister 2002).

Overall, talent and giftedness are storied positively because they seem to promise admiration and opportunities for being in the spotlight – something that influences the retrospective construction of the developmental pathway in a very existential manner. However, relying on the admiration of significant others or the media, rather than being certain of their own abilities, puts *searching for the spotlight* storytellers at risk of losing their sense of self-worth when they are not able to perform well, for example because of illnesses or injuries (Garces-Bacsal 2014). Therewith, *searching for the spotlight* stories are not necessarily sustainable over time since they depend on outcomes (such as receiving attention, performing better than others) that are out of the high-achievers' direct control (Spence 1982; Carless and Douglas 2012).

Straightforward Career

The *straightforward career* narrative represents those stories on developmental pathways whose structure follows a clear upward trajectory. These life stories display a clear sequence of career-relevant events that typically begins with engagement in the respective field at an early age, followed by early successes in competitions, smooth transitions from one level of competition to the next, and a problem-free transition from the junior to the senior performance level.

When Jack, an assistant professor in mathematics, described how he began to teach himself programming at the age of ten, he offered the following account:

> So, I had started to learn programming because I was interested in programming computer games. (...) Later I also participated in programming competitions, or computer science competitions. That was also quite important for me.

In this account, the stage-like nature of the *straightforward career* narrative becomes apparent. Jack 'started' with learning computer programming, and 'later', as the logical next step, he 'participated' in competitions. For the listener, this narrative type sounds like the description of an ideal career pathway that could be portrayed in coaching or education textbooks.

Overall, the personal life story recounts an upward career trajectory. In the storytellers' constructions of their developmental pathways, every event is followed by a logically connected event that is one step further on the job ladder. Through presenting the developmental pathway as a clear upward career trajectory, *straightforward career* stories seem to reinforce cultural stereotypes and myths about talent and giftedness, suggesting that gifted individuals have everything going their way and 'will make it on their own' (Subotnik, Olszewski-Kubilius, and Worrell 2011, 8).

Straightforward career storytellers rarely mention non-career related events; it seems as if such events do not play a role in the storyteller's construction of self in the personal life

story, echoing remarks of (Stambulova 2016) that high-achievers often skip over details of their lives outside of their performance domain in most career research. As listeners, we do not get an idea who the person might be without being embedded into the high-performance context. Rather, the person becomes intertwined with the job, creating a monological self (Lysaker and Lysaker 2006) with an exclusive identity, reminiscent of the concept of identity foreclosure in elite sports (Brewer, Raalte, and Linder 1993; Brewer and Petitpas 2017). Through its monological and linear structure, the *straightforward career* narrative resembles the performance narrative described in the work of Douglas and Carless (2006) and Carless and Douglas (2012).

However, instead of solely focusing on individual agency as could be expected in such a performance script (Carless and Douglas 2013; Ezzy 2000), tellers of *straightforward career* stories do not minimise the importance of others. Rather, they often refer to certain individuals such as teachers or professors that haphazardly sparked their interest in a specific mathematical field or a music teacher that optimally supported them in their development. Felix, a young drum player, recounted: 'Yes, I started at the music school and I was really LUCKY, because in retrospect, this is the best music school teacher you can get within a radius of 50 kilometres.' Felix is well aware of his luck of living in a city in which the best music teacher in his region – at least in his perception – works. Jack also recounts his 'luck' with his supervisor in that he offered him an 'ideal topic' for his dissertation. Through his own agency, then, Jack was able to obtain important mathematical insights, which – in his construction – lay the foundation for his career. However, when reflecting on the role of luck for the developmental trajectory, it remains ambiguous – both for storytellers and listeners – whether successes could solely be attributed to luck, or whether the high-achievers themselves were able to seize opportunities and take their chances. In Jack's words, 'I don't know if it was luck or if I chose it well (…)'. This account reflects how difficult it sometimes

is for storytellers to differentiate the role of their own agency and the role of luck when recounting career-related decisions. As Koro-Ljungberg (2002) puts it: ‘What is considered luck by some may also be interpreted as problem solving, creativity, or intuition by others’ (222).

Individuals who story their developmental pathway as *a straightforward career* neither say about themselves that they are gifted or talented, nor do they explicitly attempt to dismiss such notions. When recounting his first, not so successful experiences at competition, and what finally led to success on the second attempt, Jack offered the following account:

> This was not so much the case at the first National Computer Science Competition. And that's why it didn't work then. And then I started, eh, well, through the National Computer Science Competition I started to obtain books on algorithms and data structure. And, eh, then I improved my knowledge there considerably, so that two years later, on my second attempt, I won the National Computer Science Competition. And it went a bit similar at the National Competition of Mathematics. I had just participated, but I hadn't found a really good, uh, introductory mathematics book yet for the first semesters of study. I simply had not known one yet. I finally got one through the student academy, which I got through the Federal Mathematics Competition, and then I came across books on analysis and linear analysis. And I taught this myself and that's why I won the National Mathematics Competition afterwards.

Here, Jack perceived ‘coming across really good books’ and teaching himself the required knowledge as prerequisites for his successes at subsequent competitions. Tellers of *straightforward career* stories resemble what Koro-Ljungberg (2002) terms gatekeepers in her study on eminent professors. Gatekeepers are the classic example of a hard-working and achievement-oriented individual for whom career-related goals are central in directing life and career choices. Often, *straightforward career* stories barely contain references to emotions even when storytellers recount events that could be interpreted as critical life events (cf. John, Gropper, and Thiel 2019). For example, in the previous quote, Jack talked about his unsuccessful experiences during his first math competitions as a teenager. However, it seems as if these experiences did not affect his well-being or sense of self-worth; he only stated ‘it

didn't work then'. This unemotional reaction could be interpreted in two ways. One explanation would be that *straightforward career* storytellers possess a definite internalised sense of giftedness (Fahlman 2004) and rest so much in themselves that negative events do not have an impact on their overall well-being. Another explanation would be that the apparent lack of affectivity in their life story represents a defensive mechanism 'to make (…) stories more tellable than they might otherwise be and to keep other potentially storied accounts from reaching the status of ever being told' (McAdams 1998, 1127).

Overcoming Obstacles

Obstacles characterise the whole developmental pathway in the *overcoming obstacles* narrative. Despite manifold remembered successes, storytellers never seem to be fully certain of their achievements and abilities, which is depicted in the following statement by Jane, a track and field athlete: 'In the end nobody cares about what you have achieved once, but it is always only about what you accomplish today and what you can achieve tomorrow.' When things go well, *overcoming obstacles* storytellers perceive themselves as talented and brilliant, but when 'bumps in the road' appear, their self-image as a talent is shattered in an existential manner.

In the beginning, the *overcoming obstacles* narrative resembles the *straightforward career* narrative because storytellers talk about early successes and signs of talent, such as the following extract from the beginning of Helen's (a full professor) life story illustrates:

> There was a mathematics club and the teachers noticed me relatively directly and asked me to go in and participate. Yes. And that was, well I believe on the one hand this experience just to be addressed, to be told you have a special talent, eh, was important.

However, despite such promising beginnings, storytellers soon point towards obstacles and state that things did not go as well as anticipated. When recounting her experiences at the Olympic Games, Jane offered the following account:

> And, uhm, today I'm sitting here and everybody said "Enjoy it, enjoy it, because the day is coming when not everything is going well". And I never did, I never understood it AT ALL. I always thought: "Huh? What? What do people say? It does fit, it will always fit." And today I'm sitting here thinking, "If you'd have done this once." (...) But as I said, at that time, I think I didn't quite understand that sentence, um, and I didn't really think that at some point it would be like that, that you really can't run, you can't achieve performance standards and cannot compete AT ALL. I think I was not aware of that. You could say that I wish I had been aware of it.

In this statement, it becomes apparent that the athlete wished she would have been more aware of the fleeting nature of success. She suggests that such an awareness would have allowed her to enjoy the Olympic Games, the peak of her career, more fully, and to cope more successfully with subsequent bumps in the road such as injuries, bad performances in important competitions, or changes in the coaching team. Her belief echoes results of several studies suggesting that high-achievers might benefit from adverse events in terms of personal and performance development if they are adequately prepared for such (Collins, MacNamara, and McCarthy 2016; Howells, Sarkar, and Fletcher 2017; John, Gropper, and Thiel 2019).

Such a lack of awareness of potential obstacles along the road is characteristic of the *overcoming obstacles* narrative. The consequence is that when obstacles arise, storytellers experience a difficult and often painful time in their lives. Tony, a volleyball player, recounted:

> I played first league volleyball. (...) Eh, when I think back today, the best year I've had so far, I would always like to go back. Unfortunately, I can't. We were incredibly successful in the first half of the season and were in fourth place, with a team from which nobody expected anything. And that as a young player, where I actually went and said, “ok, I can prove myself, but I don't think I'm really playing yet”. And at the end of the season, I was able to say that I had most shares of the game on the position. (...) And in the second half of the season we were told that there were financial problems. And the club unfortunately went bankrupt after my first season. (...) That was, I think, a VERY drastic experience in all areas, of sports, in human terms. (...) I was only 20 years old and then, yes, I had nothing more and didn't know how to go on.

The account begins positively; Tony states that he had ‘the best year’ in his career ‘so far’. By the use of ‘so far’, he forecasts the struggles he experienced when his club went bankrupt. The following time period marked an important change in his life story and can be conceptualised as a turning point (cf. McAdams 2008). In this sense, the decidedly positive narrative of the pre-bankruptcy phase reinforces the negativity and significance of the turning point in the context of the overall life story.

Turning points in this type of narrative are often the beginning of a ‘rollercoaster’, as one athlete put it, of being ‘stuck’ in ‘highs and lows’. The lasting internalisation of such a self-description can come with costs in terms of overall psychological well-being due the tight connection of self-worth and achievement (Ironside, Johnson, and Carver 2020). Particularly for older and more experienced high-achievers, however, such a ‘rollercoaster’ experience can also lead to questioning the *citius, altius, fortius* logic that characterised the first parts of the talents’ life stories. Hence, when obstacles arose continually, the talents recognised the costs of such a career and the threats such a story can pose for their identity and well-being (see Douglas and Carless 2006; Carless and Douglas 2012, 2013; Howells and Fletcher 2015), as the following quote from Connor, a jazz musician, suggests:

> In this world of PERFORMANCE, so to speak, it is somehow important how you tick inside. And that there is something like, that you reflect, that it is not only about being the best, but that there, that it is also important to stay somehow healthy, mentally and physically, and that there are higher goals, really.

Here, Connor experienced adversarial growth at a psychological level over time (Tamminen, Holt, and Neely 2013; Howells, Sarkar, and Fletcher 2017; John, Gropper, and Thiel 2019), so that the story’s turning point resembles what Denzin (1989) describes as an *epiphany.* Topics such as self-exploration, self-actualisation, and seeking a new purpose in life that goes beyond ‘being the best’ gain increasing importance. Thereby, the *overcoming obstacles* narrative shares features of numerous stories about successful athletes that circulate in our

culture. Typically, such stories include ‘heartache and pain but end with overcoming obstacles and achieving success’ (Douglas and Carless 2006, 14). Due to the suspense such redemptive storylines create, they make up good stories (McAdams 2013).

However, although experiences of obstacles can lead to a feeling of personal growth, most *overcoming obstacles* storytellers appear to develop massive self-doubts with regard to their talent, which is not completely uncommon for gifted individuals (Guthrie 2020). As Connor puts it: ‘So, one wishes for applause based on the assumption that only then one is safe. Behind this is the belief that you are not safe. You walk around in the world, but something can always go wrong.’ For Connor, applause promises safety, an inner safety that most tellers of *overcoming obstacles* stories seem to lack. Here, the difference to *searching for the spotlight* stories becomes apparent, in which applause is needed as evidence for being at the centre of attention.

Hence, *overcoming obstacles* storytellers seem to not possess an internalised sense of their giftedness, what becomes particularly evident when things do not go as they should. When Bert, a jazz musician, experienced embouchure problems – which are serious, career-threatening disorders for brass instrumentalists (Steinmetz et al. 2014) – he began to question his talent: ‘There are so many naturals who NEVER had such problems, who actually always did everything right and for whom it doesn't matter which teacher they come to, because they just have to play, practice, and then it works.’ In his perception, real talents, or in Bert’s word, ‘naturals’, would not struggle with setbacks; for them, everything simply ‘works’. In this sense, he seems to lack alternative narrative options, which could help to reframe his experiences in a way that would not threaten his whole identity, and, thereby, might be more conducive to psychological well-being (cf. Adler et al. 2016; McLean and Syed 2015; Cavallerio, Wadey, and Wagstaff 2017).

Riding the Waves

A positively perceived immersion into the respective high-performance system characterises the developmental pathways described in the *riding the waves* narrative. Here, storytellers deeply enjoy being part of such a system, and perceive their involvement as a way of living.

Riding the waves stories often start with an episode that demonstrates openness to new experiences such as formative travels with the family, as can be observed in the following account by Holden, a track and field athlete:

> But at that time, we often travelled with my parents. They always travelled to Namibia and South Africa. I was maybe three, four, five back then. So I was there five times at a very young age and that certainly influenced me somehow. (...) And I could imagine that this of course led to the fact that later on, especially now, you travel a lot through sport and I have developed a certain open-mindedness for it.

In contrast to the other types of narratives in the current study, the focus on new experiences (such as competitions, training camps in different parts of the world) runs as a thread throughout the whole story; even challenges are encountered with openness and curiosity. New experiences gain significance for the developmental pathway in terms of experiencing life in a full and multidimensional sense rather than solely in terms of success. Therewith, the *riding the waves* narrative shares some features of the discovery narrative described by Douglas and Carless (2006) in elite sports.

Riding the waves stories are not devoid of obstacles. But rather than storying these as insurmountable challenges, obstacles are coherently integrated into the overall plot of the story. Obstacles are construed as natural parts of the path to high achievement and of the respective high-performance system. As Ryan, a tenured professor, put it: ‘Somewhat small setbacks all the time. (…) But I think this is simply the nature of research.’

Despite depicting a positive immersion into the high-performance system, *riding the waves* stories are not characterised by a simple acceptance of and unquestioned commitment

to performance expectations (Hughes and Coakley 1991); rather, throughout the whole developmental pathway, storytellers look for opportunities that open up new identities as the following excerpts from Holden's life story illustrate. As a track and field athlete, he suffered from various severe injuries during his career. When he had to cancel his race at the Olympic Games due to a serious injury, he recounted:

> And then, of course, this was an enormously difficult phase mentally, how to deal with it, because it was one of the most difficult phases I have had in my career so far. But from that, too, extremely important things emerged.

Instead of dwelling on his disappointment, Holden takes an alternative perspective. Beside building a social support network in sports, he was able to secure a position as a student trainee, describing the importance of the latter event in the following words:

> Then this is actually the pillar for me, which is independent of my sport. And that is very important because everything else is always performance-related. And that's the only thing I earn or the only professional insights I get, which are independent of sport. And this is also/also a result of the injury, only that at least something good came out of it.

In a situation (suffering from an injury that prohibits his start at the Olympic Games) in which Holden recognises that he an object of chance with limited control over his developmental pathway, he reclaims his role as an active subject through concrete and conscious actions (cf. Carless and Douglas 2013). Such an *active agent* identity position is a characteristic of polyphonic narratives (Ezzy 2000). In polyphonic narratives, stories and values are often 'overlaid, interwoven and often contradictory' (Ezzy 2000, 613), which can be seen in the following quote from James, another track and field athlete: 'Then I was, eh, yes, qualified for the World Championships. Me, that little boy from the village.' Here, James juxtaposes his experiences as an athlete 'qualified for the World Championships' with his self-perception as the 'little boy from the village' who often struggled with homesickness during training camps and competitions. But rather than suppressing these contradictions and tensions in his story, he tells a story from multiple self-positions embracing the complexity in

his life. As research indicates, polyphonic stories have positive implications for both psychological well-being and long-term personal development (Ezzy 2000; Carless and Douglas 2013). Tellers of *riding the waves* stories also encountered several adverse life events; however, in contrast to most *overcoming obstacles* storytellers, they reported better psychological well-being and a more positive perspective on their future. They seem to refuse to adopt an exclusive athletic identity; rather, they favour to sustain a broad-based multidimensional identity, embracing the tensions in their life stories that result from such an identity position (Carless and Douglas 2013).

In the *riding the waves* narrative, talent and giftedness function as door openers for exploring the world and getting to know new cultures and people all over the world. Talent does not determine the storyteller's self-worth but rather functions as a vehicle for personal development. Holden put it this way: 'Sport has opened every door for me so far.' Rather than tying their self-worth to achievement like *overcoming obstacles* storytellers, tellers of *riding the waves* stories appear to have a need to explore and discover life that often takes precedence over the need to perform.

Applying effort

The fifth type of talent narratives depicts a developmental pathway where *applying effort* in the pursuit of mastery is storied as the factor that leads to success. A*pplying effort* storytellers try to distance themselves from preconceived notions about talent and giftedness in that they emphasise that they were 'quite normal', having had problems in school or during their studies. Thereby, they establish an anti-talent story. Una, a full professor, offered the following account in the beginning of the interview when she reflected on her early experiences with mathematics:

> In the beginning I was, I did not have a very good contact to mathematics. I think I was quite normal. In 7th grade I was DESPERATE because I thought I had chosen the wrong branch of school. (Laughter) Eh, that's when I went to the science branch and didn't understand why

> minus times minus equals plus. So, eh, I was very desperate and at that time there was certainly no special affinity for mathematics.

Throughout her whole life story, she tries to narrate a story of being normal. Often, *applying effort* storytellers explicitly compare themselves to those that are the truly gifted ones in their eyes, thereby creating a divide between them (i.e. the not so-talented ones) and the others (i.e. the truly talented ones). In their view, truly talented and gifted individuals would go to schools with gifted programs, achieve early athletic success, or could play a piece of music perfectly without a lot of practice. Such assumptions might be influenced by the common notion of professionals who tend to define giftedness as being different from the norm (Fahlman 2004). Samuel, a jazz musician, offered the following reflections about talent and giftedness:

> It's always the question somehow, what one / what is talent and what not. But there are people who, uh, see or hear something and can immediately put it into practice. And then they do it really well from the very beginning. And they could/could do that at a very young age. And in comparison to them, I looked like a, like a complete idiot. (Laughter) To be honest. There was also the point where it was suddenly completely different. Namely that point where I noticed how everything worked. How things work for me. In terms of practicing. And then I learned, okay, I have to do it this way and that way and that way AND THEN it was suddenly completely different. Then the others suddenly thought that everything is very easy for me. But that wasn't really the case, I just learned how to do it, how I have to practice and then I just DID it.

Samuel concludes that he is not talented but rather looked ‘like a complete idiot’ who relied on practice. He further explicates: ‘Even if you are not necessarily someone who just has to look at your instrument and it works. I was actually more of a WORKER.’ Samuel seems to not recognise the dissonance in his account. Whereas he attributes his success solely to having learned how to practice and apply effort, he believes that real musical talents just have to look at their instruments, and, then, ‘it works’. It appears as if it does not come to his mind that those who he perceives as talented might actually have also succeeded through working

hard. The idea that hard work and not intelligence or talent leads to achievement is actually quite common among gifted individuals (Fahlman 2004), and in line with Ericson's work on the role of deliberate practice for expert performance (Ericsson, Krampe, and Tesch-Römer 1993).

Another way in which *applying effort* storytellers distance themselves from typical notions of talent and giftedness takes place at the story's structural level. When an episode in the life story could be interpreted as evidence of talent, another episode refuting such perceptions immediately follows. At these points, the story often leaves its chronological structure. Evelyn, a track and field athlete – after talking about her success at the European Championships the year before the interview – goes back in her story to her teenage years during which she struggled to qualify for regional championships in athletics. Additionally, she also recounted experiences in different sports:

> Evelyn: I still did taekwondo and children's gymnastics.
> Interviewer: Okay, then we'll write that down again. At least if you can say that it was somehow important for you.
> Evelyn: Ah, it was just important or it just showed my lack of athletic talent.

Here, she constructed her engagement in other sports as important in so far that these experiences demonstrated her 'lack of athletic talent'. In contrast to *overcoming obstacles* storytellers whose talent-related self-perception fluctuates dependent on whether they are successful or not, *applying effort* storytellers appear to be convinced of their lack of talent and obstacles do not represent a threat for their identity. For them, talent and giftedness – if understood as natural ability – are not prerequisites for success. Rather, a deep passion that enables storytellers to derive meaning and purpose from their work is constructed as the actual driver of hard work, as the following account by Noah, a full professor, indicates:

> So with the natural ability, I can see that anyway, that has an influence of course, but the greater influence, the much, much, much greater influence in my, in my opinion, is just that,

> the enthusiasm for it. That you enjoy it and if you enjoy it then (...) then you can also achieve something with the skills you have.

Within such stories, and as Noah's quote illustrates, talent and ability are portrayed as secondary to passion or 'enthusiasm'. In *applying effort* stories, the process of being effortful is portrayed as a defining characteristic of the teller's sense of self and perceived as valuable in its own right. Evelyn had this to say: 'The more athletics I did, despite my lack of talent, the more I realised that if I put in the effort and train hard, I would get better.' Such a focus is more controllable than solely concentrating on performance outcomes. As Garces-Bacsal (2014) suggest, such a perspective might be particularly helpful during difficult times along the talent development pathway with potential positive implications for well-being and long-term development (Mudrak 2011; Carless and Douglas 2012).

Conclusion

The aim of the study was to explore the talent stories of elite athletes, musicians, and mathematicians, particularly with regard to the question how cultural ideas about talent and giftedness impact the retrospective construction of the developmental pathway. By conducting and analysing 30 life story interviews, we constructed a typology of talent narratives: *Searching for the spotlight, straightforward career, overcoming obstacles, riding the waves,* and *applying effort* narratives. To the best of our knowledge, the current study is the first that compares life story accounts of high-achievers from different achievement domains. Therewith, our research extends previous narrative research on success stories in elite sports (Douglas and Carless 2006; Carless and Douglas 2012) by illustrating how cultural ideas about talent and giftedness impact storytellers' constructions of their pathways at a thematic and structural level. Furthermore, our analysis shows that talent stories are not domain-specific but group across domains, in our case music, sports, and mathematics. However, since typologies risk putting stories into boxes (Frank 2010), it is important to bear

in mind that types of narratives are always tentative and individual life stories are constantly evolving (Ronkainen and Ryba 2019).

In order to grasp the self-referential nature of talent narratives, we applied the ideas of radical constructivism (Maturana and Varela 1992) to given theoretical approaches on stories and narratives. Our approach allowed us to identify a specific *self-organising principle* within each type of narrative that impacts the story's construction in a self-referential manner. An example for such a self-organising principle is the depiction of the developmental pathway as a continuous sequence of talent-confirming and talent-disconfirming events in the *overcoming obstacles* narrative. Thereby, storytellers construct an identity position that is characterised by a constant feeling of insecurity - of never really being certain of oneself and one's talent.

In this sense, individuals can be regarded as *constructors* of their own development (cf. Schimank 1988). What is meant by this is that societal master narratives about talent and giftedness gain personal relevance for the individual storyteller according to his or her own biographical logic. In our analysis, the self-referential biographical logic of talent stories could be identified in the story's content and structure. For example, even though all storytellers follow culturally accepted storylines when they emphasise the importance of hard work, even for talented and gifted individuals (cf. Johnson et al. 2008), the motives for hard work differ across the types of talent narratives: (a) In *searching for the spotlight* stories, the hunger for recognition fuels hard work; (b) In *straightforward career* stories, hard work is depicted as coming natural to storytellers; (c) Self-doubt and the search for an inner safety lead to hard work in *overcoming obstacles* stories; (d) *Riding the waves* storytellers are willing to work hard for the sake of exploring the world; (e) and in *applying effort* stories, a deep passion for the field of interest fuels the process of hard work in the pursuit of mastery.

At a practical level, such knowledge can help practitioners such as teachers or coaches to tailor the individualised motivational climates accordingly (Roberts et al. 2015).

Similarly, nearly every talent story we identified refers to the master narrative that developmental pathways of highly gifted people are characterised by obstacles. In this sense, our findings echo research in sport and exercise psychology (Sarkar, Fletcher, and Brown 2015; Hardy et al. 2017) and within the field of academic high achievement (Koro-Ljungberg 2002), where learning and living through obstacles appeared to be a grounding force in the continuum of stories on developmental trajectories. However, our analysis shows that the way how obstacles are interwoven into the overall story line depends on the biographical logic of the storyteller's developmental pathway: High-achievers who narrate their pathways as a *searching for the spotlight* narrative rarely story negative life events as obstacles for their performance development. Rather, they are perceived as threats for their identity since their sense of self relies on receiving attention through others. Developmental pathways that are depicted as a *straightforward career* hardly contain obstacles, and if they do, they are dealt with in a problem-oriented manner with barely any emotional involvement. In the *overcoming obstacles* narrative, the constant overcoming of obstacles with resulting fluctuations in storytellers' self-image as talents is the main characteristic of the developmental pathway, whereas in the *riding the waves* narrative, obstacles are perceived as a very natural part of the path to high-achievement and barely have any consequences for storytellers' sense of self. Last, *applying effort* storytellers interpret obstacles as a confirmation of their lack of talent and as an indicator that they need to work harder.

Even though nearly every life story contains some adversity, high-achievers often perceive problems as unique to their story and seem to believe that they are the only ones who had such problems. Such feelings might hinder a relational orientation during development and restrict alternative narrative options (Guthrie 2020). Thus, sharing and

circulating different stories might help other high-achievers or aspiring talents to feel less alone in their experiences (Douglas and Carless 2006). By re-telling certain stories, and omitting others, professionals who work in talent or giftedness domains play a part in enabling or constraining the lives of aspiring talents in sports, music, mathematics, or other domains (cf. Sparkes 2004).

Life stories of high-achievers can serve as useful examples of various ways to construct talent, giftedness, and success by illustrating factors and key events identified as important to talent development from their perspective (Koro-Ljungberg 2002). When we observe and study how individuals construct their life stories, we can gain a glimpse into the world views they have. Such insights are essential for designing individualised talent development strategies and other measures of support for talented and gifted individuals. Due to the uniqueness of an individual's life, we cannot expect to find a single best way to support talented or gifted individuals in their development. Rather, we can value different ways of perceiving, living, and developing talent and giftedness, and encourage aspiring talents to embrace the saying, *all roads lead to Rome*.

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6 Final Discussion

6.1 Overall Discussion of Key Findings

The dissertation aims to offer a social scientific perspective on talent research. Within the previous chapters, I have summarized the current state of talent and giftedness research and identified research desiderata at a theoretical, methodological, and empirical level. The starting point for my work is a social constructivist paradigm, which I have described in my theoretical background (see Chapter 3). As I have argued, talent development efforts are mainly concerned with the question of how processes of 'fit-making' work; in other words, how can an individual with his or her unique history be made fit to a specific environment, or how can the environment be made fit to the individual.

To answer this question, I have discussed the characteristics of the life worlds of elite athletes, professional musicians, and mathematicians. Next, I have described how the concept of the life world that is located at a social level can be combined with a personal perspective on the individual's unique life experiences. In this regard, I have argued that the concept of narrative provides a bridge between 'the personal' and 'the social' when examining talent development from a social constructivist perspective.

As discussed in Chapter 2, stage-like talent development models are often the theoretical basis of most talent research (Bloom, 1985; Côté, 1999; Wylleman & Rosier, 2016). However, the idea of uniform and linear stages stands in stark contrast to research on the developmental trajectories of high-achievers that shows very idiosyncratic pathways to excellence with a multitude of factors interacting with each other throughout the talent development pathway. The complexity of this interplay is extremely high, not only in view of a large number of reference partners potentially relevant for a career and the idiosyncrasy of biopsychosocial predispositions but also because of the dynamics of individual components over time (cf. Durand-Bush & Salmela, 2002; Phillips et al., 2010).

The seven papers that build the main part of the present dissertation address some of the described limitations of current talent research and aim to contribute to a social scientific perspective on talent and its development. Previous work within the field has its merits and strengths, but it also has its blind spots. In the following, I discuss the theoretical, methodological, and empirical implications of my work, particularly highlighting the golden thread across the seven research papers.

6.1.1 Discussion of theoretical deliberations

Whereas previous scholarship with regard to talent has mostly been based on the assumption that it is possible to predict future performances based on selected traits and skills assessed at an early age, the present dissertation argues for a more complex, social scientific view on talent development processes. Therefore, in Article 1, we present a theoretical framework that takes the asynchronous, multidimensional, and dynamic nature of talent development seriously. To counteract the described limitations of current theoretical models, we build our deliberations in Article 1 on sociological systems theory. Herewith, we take a step further than current dynamic systems approaches within talent research (e.g., Phillips et al., 2010; Seifert et al., 2018) that often lack a clear theoretical foundation. Particularly, these approaches suffer from conceptual shortcomings with regard to the ‘system’ concept that is often not clearly defined.

Within Article 1, we address these shortcomings by offering a systems theoretical understanding of talent. We consider talent as a social construction that is historically changing and contextually embedded (John & Thiel, under review). Organizations such as sports associations or music conservatories act as ‘purchasers’ of talent and therefore have a monopoly on defining talent. Following these reflections, within talent development processes, a person is made fit to the performance expectations of the respective organization. We used the example of athletic talent within the aforementioned theoretical paper to

practically illustrate our theoretical deliberations. However, it is important to note that the proposed conceptualization of talent can also be transferred to other achievement contexts, such as music or mathematics. As I have argued in the previous chapters, the underlying question of nearly all talent development efforts regardless of the specific achievement domain is similar (i.e., how to make an individual with his or her unique history fit to the respective environment or how to make the environment fit to the individual).

One major implication of a systems theoretical conceptualization of talent is that living systems change in self-referential ways. Perturbations stemming from the respective social environment (such as interventions by the coach or mentor, conflicts, or life events) become information according to the individual's internal logic that is shaped by his or her history and anticipated future. This is in line with work in general psychology that suggests that individuals' reactions to interventions, life events, etc., vary greatly and are shaped by individual interpretative meaning-making processes (cf. Schwarzer & Luszczynska, 2012). Autobiographical research demonstrates that the meanings derived from experiences often steer future experiences; how individuals interpret their past appears to be more decisive for future behavior than the objective 'facts' of the past (cf. Geraerts et al., 2008). Particularly life events can often lead to or require major changes in thinking or behavior since they question taken-for-granted assumptions about the world and oneself (e.g., Linley & Joseph, 2004; Tedeschi & Calhoun, 2004).

Within Articles 2 and 3, we specifically focus on the impact of life events on complex behavioral processes. In Article 2, we use physical activity behavior as an example; within Article 3, we specifically focus on the biopsychosocial development of high-achievers. Physical activity behavior can be thought of as a complex and fluctuating behavior, marked by lapses and relapses along the life course (Gropper et al., 2020). Physical activity behavior shares some conceptual overlap with performance development, which plays a major role in

talent development processes and also often does not progress linearly. Both papers show that life events can be conceptualized as natural interventions across the life course, can trigger periods of biopsychosocial adaptations, and can lead to behavioral changes, some of which can be positive and others negative.

Particularly, the findings of Article 3 illustrate that it is not simply the life event per se that results in positive or negative consequences for the talent development pathway. Rather, the individual appears to interpret such experiences according to his or her own logic, which is shaped by previous experiences and sociocultural factors. This is in line with our systems theoretical conceptualization of talent. Whether individuals benefit from life events in terms of personal and performance development, for instance, through adaptive behavioral changes, seems to depend on the coping strategies employed. Thus, the consequences of a life-event-related experience are dependent on the individual, echoing remarks by Schlossberg (1981) on the subjective nature of transitions within individual life courses.

Concluding from our theoretical deliberations, and in line with other researchers within the field of human development and talent development (Dai & Renzulli, 2008; Vallacher et al., 2002), the timing of certain experiences and exposure to certain events have to be considered as crucial factors for developmental trajectories (John et al., 2019). Consequently, it is unlikely that a singular optimal pathway to high-achievement can be identified and applied to all individuals. From a social constructivist viewpoint, the characteristics or behaviors of individuals are the actualization of one of the principally countless possibilities to ‘survive’ within the given environment. The environment itself never determines how such ‘survival’ should be achieved (von Glasersfeld, 1992). Instead, individuals construct reality in such a way that it ‘fits’ to their experiences and allows for future ‘survival’. Their knowledge of reality is just one possible way to productively make sense of experiences and give them meaning. Therefore, to understand how ‘talent’ develops

in different performance domains, it is essential to examine the nature of each individual's intrinsic dynamics. Research should particularly focus on temporal aspects of the developmental process (John & Thiel, under review). While population-based studies on associations between predictor variables and excellent performance variables provide crucial information, they cannot substitute individual-based studies on processual aspects of talent emergence and development (Phillips et al., 2010).

6.1.2 Discussion of methodological deliberations

For talent research, this raises the question of the appropriate method to capture individuality. Given that static, present-day analyses do not go far enough to describe the mechanisms of individual talent development, we need methodological approaches that are sensitive to personal and social factors and their interaction along the developmental pathway. In talent research, such approaches have so far been the exception. There are several analyses that deal with a multitude of facilitating and constraining factors of talent development within different stages of the talent development pathway (e.g., Howells et al., 2017; Li et al., 2014; Rees et al., 2016; Sarmento et al., 2018; Smith et al., 2018); but, an overall perspective on complex developmental processes is lacking.

In accordance with our systems theoretical conceptualization of talent, the individual considered talented processes inputs from the environment according to his or her own logic. This means, in order to offer inputs that fit to the individual's own logic and might lead to adaptive changes in thinking and behavior, it is necessary to gain an 'inside view'. In line with a social constructivist perspective on development, humans make meaning of their experiences through telling a story about their lives (cf. Richardson, 1990). In all three theoretical papers, we have advocated for biographical retrospective studies to assess life events and their impact on developmental processes. Narrative analyses afford us with the opportunity to study (a) why and how life events become subjectively meaningful, (b) how

they account for changes in behavior across the life course, (c) which underlying meanings are attributed to behavioral changes, and (d) how cultural ideas and norms with regard to talent impact subjective constructions of experiences (cf. Gropper et al., 2020; John et al., 2019; John & Thiel, in revision).

While quantitative approaches are fundamental to some research questions within talent research, qualitative research can provide in-depth insights into individuals' perspectives and experiences within different achievement domains. With qualitative research, the impact of talent-related sociocultural norms on overall development can be assessed from the perspective of all relevant stakeholders within the context of talent development. Ultimately, the way we develop and carry out talent management strategies should be informed by the experiences and perspectives of all those involved (cf. Bekker et al., 2020). By embracing and examining the complexities of individuals' perceptions and experiences (Bekker et al., 2020), qualitative approaches can help to move away from a one-size-fits-all approach to talent management to more individualized talent management strategies.

When concerned with how life events shape and impact developmental processes, narrative interviews represent the gold standard since life events are the building blocks of life stories (Filipp & Aymanns, 2010). With narrative interviews, we aim to gain an in-depth understanding of people's perceptions, feelings, knowledge, and experiences (Thiel et al., 2019). Further, we aim to examine how experiences are constructed and put together within a story to provide lives with unity and purpose. Despite the constitutive role of the body within and for individual experience (cf. Merleau-Ponty, 2004) and the construction of the self (Van Wolputte, 2004), the analysis of the body is often neglected within qualitative and specifically narrative research.

Within Article 5, we reflect on this limitation and argue for greater awareness of bodily phenomena in qualitative research studies. Human beings are bodily situated in their respective life worlds; body and mind are interwoven in fundamental ways so that all learning experiences are also bodily mediated (cf. Alerby & Ferm, 2005). Therewith, these reflections also become relevant in the context of talent development. Since elite sports is the achievement domain most closely associated with the body, we can find a number of studies stressing the importance of bodily experiences and embodied phenomena along the talent development pathway of athletes (e.g., McNarry et al., 2021a; McNarry et al., 2021b; Schubring & Thiel, 2014a, 2014b). However, also for other fields such as music and mathematics that appear to be more closely connected with the mind than the body, we can find scholarship on embodied phenomena. Alerby and Ferm (2005) illustrate that making music itself is an embodied experience; musicians often experience the instrument as an extension of their bodies. The authors even go as far as arguing that to be able to play a piece of music at a high level of artistry, the music instrument as well as the music itself have "to be incorporated in the musician's body" (Alerby & Ferm, 2005, p. 181). Similarly, mathematical ability is also often seen as an embodied phenomenon (Epstein et al., 2010; Moreau et al., 2010). However, spoken words cannot fully capture all aspects of embodied and bodily phenomena. In line with other researchers (Schubring et al., 2019; Sheridan et al., 2011; Tarr & Thomas, 2011), we suggest that visual approaches might supplement and expand the more traditional interview approaches (Thiel et al., 2019).

A way to combine a qualitative interview approach with the visualization of experiences is the biographical mapping approach (Thiel et al., 2020). Based on the assumption that biographies are characterized by 'chaotic structures' (Frank, 1995), we developed a visual tool to help participants depict the complexity of these structures and help express details about sensitive topics, emotions, and experiences. With this method, it

becomes possible to map different dimensions of biopsychosocial developments over time (such as general well-being, psychological strain, performance capability) that cannot be fully captured within traditional interview approaches – at least not in their temporal nature. Traditional methodological approaches within current research on the role of critical life events for talent development pathways do not allow clear statements on how specific life events influenced particular aspects of development. Instead, within our systematic review, it was only possible to conclude that critical life events impact biopsychosocial development on multiple levels (John et al., 2019).

Biographical mappings would offer the opportunity to more clearly re-construct the impact of critical life events on various biopsychosocial, developmental dimensions. With biographical mappings, the pattern of events, their influences on key variables, and the multiplicative, interacting nature of variables with each other can be assessed in a time-serial, individual-based fashion. Therewith, the biographical mapping approach answers recent calls from talent researchers for methodologies that can capture dynamic and complex developmental processes (cf. Dai, 2019; Phillips et al., 2010). Further, by assessing rather general psychosocial variables such as general well-being in their temporal development, interviewees are encouraged to talk about all aspects of their lives, creating space for reflections on non-talent-related experiences that can still be meaningful for development. Thereby, a more contextualized perspective on talent development processes can be adopted, which has been called for again and again within the field (e.g., Martindale et al., 2005; Stambulova, 2016b; Tranckle & Cushion, 2006).

Besides allowing a contextualized and in-depth analysis of biographical experiences, the biographical mapping method also holds practical potential for highly individualized talent management strategies, for which several recent papers argue (Baker et al., 2017; John & Thiel, under review; Preckel et al., 2020). Practitioners could use biographical mappings to

gain better insights into high-achievers' life circumstances and, for instance, health-related developmental processes, which might eventually result in a more individualized approach to talent development (Thiel et al., 2020).

6.1.3 Discussion of exemplary empirical findings

In the empirical study I conducted as part of this dissertation, I used the biographical mapping approach to identify individual talent development pathways and critical life events. Asking highly successful performers in sports, music, and mathematics to narrate their own talent development pathways promises to provide information on the more or less important factors for talent development in each case and how these factors are meaningfully and coherently integrated into a story. Analyzing personal life stories allows us to offer insights into the intrinsic dynamics of talent development pathways (cf. Stambulova, 2016a; Young & Collin, 2004).

The narrative analysis within Article 7 reveals that we cannot define *one* clear path to excellence; instead, developmental trajectories are highly individualized, which supports our theoretical considerations (cf. John & Thiel, under review) and other scholarship within talent research (Hardy et al., 2017; Phillips et al., 2010; Rees et al., 2016). However, 'bumps in the road' were part of nearly every story on the developmental pathway, which is in line with research in sport and exercise psychology (e.g., Collins & MacNamara, 2012; Hardy et al., 2017; Howells et al., 2017; Sarkar et al., 2015) and the field of academic achievement (Koro-Ljungberg, 2002). But, how these obstacles were interwoven into the story's structure varied greatly and appeared to depend on the storyteller's biographical logic. This finding is in line with the key theoretical assumptions of social constructivism and highlights the potential of a narrative approach, which is sensitive to both thematic and structural features of stories, when studying talent development pathways.

As an apparent contradiction to my reflections on the specific characteristics of the life worlds of athletes, musicians, and mathematicians, we identified generic talent narratives that are observable across all three achievement domains. This means that, despite different structural characteristics of the respective domains (as described in Chapter 3.2), we can identify cross-domain narratives on talent development trajectories. These narratives tend to revolve around questions of how high-achievers perceive themselves as talented, how secure they are in their identities, how they make themselves fit to the respective context, or whether they even need to make themselves fit to the context. These questions seem to be more determinative in shaping the personal story about one's talent development pathway than reflections on the structural specifics of the individual context. All high-achievers seem to be asking themselves these questions, and, in their respective life stories, they try to find their answers to them while orienting themselves to sociocultural narratives on talent. In short, the stories on the developmental pathways revolve around questions of identity, echoing remarks of narrative scholars that individuals also use stories as a way to try to come to terms with their identity (Bader, 2010; McAdams, 1996; Smith & Sparkes, 2006).

As discussed in Article 5, the body is a constitutive part of personal experience and also identity construction. In the words of Baumeister, "[e]verywhere in the world, self starts with body" (Baumeister, 1999, p. 2). However, the empirical study on talent narratives shows that high-achievers only bring up the subject of the body when they suffered from injuries or illnesses, i.e., when their body did not function as required by the performance logic. Only at these critical points in one's biography does the topic of 'having a body' rise to awareness. However, from a theoretical point of view, ownership of one's body and treating it as an essential part of one's self would be relevant throughout the whole talent development process (cf. Thiel et al., 2019). Being physically and mentally fit plays a significant role in the respective life worlds of athletes, musicians, and mathematicians. Yet, it seems to be a

feature of the *culture of risk*, which characterizes all three achievement domains (see Chapter 3.2), that the body and specific sensitivities are more or less repressed, and that these issues are only addressed at key biographical moments when functional limitations arise. Therewith, however, an essential part of identity, namely one's own corporeality, is often neglected or even ignored, which can ultimately hinder the talent development process.

6.2 Implications for Talent Research

The present dissertation aims to contribute to a social scientific perspective on talent development. Within seven articles, I have offered reflections on current research and have proposed points of departure for future talent development research that considers the multidimensional, dynamic, and systemic nature of talent development processes. A strength of the seven articles and the current dissertation is its coherent theoretical framework based on a social constructivist paradigm aiming to bring social and personal aspects of human and talent development together. The paradigm is also sensitive to the historical and contextually embedded nature of the talent construct. However, in line with the nature of science, work is never completed, and further research is required to advance the field. The present dissertation can only offer the first step in this regard.

Within our theoretically-oriented papers, we have offered a theoretical framework to capture critical life events, transitions, and their influence on behavioral processes and biopsychosocial developments. Future talent research needs more prospective longitudinal studies that use repeated measures over a prolonged follow-up time to capture the temporal complexity of life events and transitions and disentangle immediate and more persistent effects on talent development processes (cf. Gropper et al., 2020). Normative transitions such as from junior to senior competition levels often represent a threat for the continuation of the talent development pathway and should therefore be investigated systematically in their

temporal nature (cf. Drew et al., 2019). Further, a biographical, retrospective perspective could provide additional insights into how individuals make sense of life events and transitions in the context of their lives. Such insights can advance our understanding of when and why individuals considered talented continue or terminate their talent development pathways after challenging life events and transitions.

Concerning life events and transitions, a further research focus could particularly be placed on coping mechanisms. As our systematic review on the role of critical life events in the talent development pathways illustrates, coping mechanisms are quite influential when it comes to the question of whether a critical life event results in positive or negative consequences (John et al., 2019). Further research is needed to examine the extent to which the coping response targets the life situation affected by a critical event or the affected person him- or herself; in other words, whether more successful coping revolves around changing the 'world' or the 'self' (Filipp & Aymanns, 2010). Such knowledge is essential in order to prepare individuals for life events and support them adequately when critical life events happen. For appropriate interventions that fit to the respective individual, it is necessary to understand the individual's own logic of behavior. An individual enters a specific achievement context with his or her own history, which inevitably influences how the individual will interpret and react to interventions.

Thus, we need research agendas that take such idiosyncrasies into account. While quantitative research also has its advantages, only qualitative research can grasp diversities in talent development pathways, life worlds, and personal meanings of life experiences (Stambulova, 2016a). Within future qualitative research on talent development, we should focus on deepening our knowledge about how individuals define and perceive themselves as talented, how they construct their identities, how these identities become embedded into and shaped by the developmental process, and how they, in turn, affect these processes. The use

of an interpretive, social constructivist paradigm shifts the focus from dealing with 'objective' layers of talent development to subjective layers of experience.

Adopting a retrospective narrative approach allows for a more holistic view of talent development that takes time, space, and the historical, social, and cultural contexts into account (cf. Cohen et al., 2004; Stambulova, 2016a). This is important since most current talent research is limited by the natural tendency of those being interviewed to focus predominantly on issues related to the respective achievement context and skip over details of their lives outside of this context (Savage et al., 2017; Stambulova, 2016a). With the biographical mapping method, we aim to offer an instrument that would allow us to better capture experiences and developmental dimensions that are not specific to the achievement context.

The biographical mapping approach might also be particularly useful for future research on topics that are difficult to narrate verbally because they are too sensitive or too complex. In the context of talent development, potential topics of interest in this regard include health-related developments, either with regard to mental or physical health. Within the culture of risk, physical and mental invulnerability appears to be the culturally demanded 'norm' (Nixon, 1993), making it quite difficult for those whose experiences do not align with these expectations to find their voice and share their experiences of ill-health. Visual approaches might offer a way to share experiences that are otherwise silenced because they are difficult to narrate, or for which no culturally available master narratives appear to exist.

The previous point also touches on another important avenue for future research. A deeper look into cultural master narratives on talent might be warranted. As discussed in the dissertation's theoretical framework (see Chapter 3.3), an analysis of individual life stories only allows to approximate cultural master narratives circulating within the broader sociocultural context. That is because master narratives are only re-constructed within the

individual stories, but personal stories can never fully represent them. Future research could analyze ‘cultural artifacts’ (Higgins & McAllaster, 2004), which touch the topic of talent, to more closely examine cultural master narratives on talent and its development. Examples of ‘cultural artifacts’ include newspaper articles, documentaries, myths about heroes within the respective fields, funding guidelines, strategic plans of talent organizations, job announcements, job descriptions, or award criteria.

The theoretical perspective on talent development proposed within this dissertation and the empirical finding that high-achievers from different achievement domains tell similar stories on their developmental pathways encourage cross-domain research on talent development pathways. The underlying phenomenon – the development of high-achievement within a high-pressure context – appears similar across achievement domains. In recent years, some conceptual papers within talent and giftedness research have also issued calls for cross-domain research (Preckel et al., 2020; Subotnik et al., 2011). However, empirical research that studies high-achieving individuals from different achievement domains is still rare, with some notable exceptions (e.g., Beltman & Volet, 2007; MacNamara et al., 2010a, 2010b). Comparative research projects would allow to culturally contextualize developmental processes, particularly when informed by a deep understanding of the systemic logic of the respective achievement domains. Comparative research on high-achievers from different achievement domains could also help disentangle those points that are specific to the respective achievement domain and those points that appear to be significant across domains. Such knowledge could help practitioners to develop more successful individualized talent management strategies. Different achievement domains could then also profit from each other and would not need to ‘reinvent the wheel’ for potentially transferable support measures for aspects within talent development that are similar across domains.

6.3 Implications for Talent Management Strategies

From an applied perspective, the findings of the dissertation call for talent management strategies that are biopsychosocially individualized. The person to be promoted must be viewed in his or her entirety, rather than limiting talent promotion efforts to singular factors such as motor or cognitive skills. Instead, it is necessary to consider the whole person with his or her unique history and the broader sociocultural context into which talent development is embedded.

In the following, I present five central theses for talent management strategies that build on the dissertation's theoretical deliberations and empirical findings. The first three theses mainly target practitioners who work with individuals considered talented in the respective achievement domains. Practitioners include coaches, mentors, teachers, professors, advisors, counselors, performance psychologists, headmasters, directors of sports teams or music schools, etc. The final two central theses target 'talent' organizations such as sports associations, music conservatories, orchestras, schools, or universities.

1) Inter- and intra-individual differences matter along the talent development pathway

Thesis 1 forms the basis for all the following premises. Individuals considered talented need support measures that are adapted to them in accordance with their current developmental stage. Inter-individual differences need to be considered; what is successful for individual A at time x may not be the same for individual B. The same plan does not work for everyone; there are no simple recipes as development is dynamic and complex. To make things even more complex, intra-individual differences have to be considered as well; what was once successful for individual A may not be appropriate two years later for the same individual due to experiences made and possible changes within the individual's own logic of behavior.

Thus, for successful talent development to occur, a very individualized engagement with the individual is required – at least if the goal is to support his or her long-term development

2) Initiating self-reflective processes is crucial for successful long-term talent development

Talent development strategies have to focus on the performer as an individual rather than using generic strategies that might not fit to every performer's inner and outer environment. Without an understanding of the meaning-making process on behalf of the performer, practitioners will not be able to offer the conditions necessary for the particular individual to succeed, not least because the individual's logic of behavior is neglected.

Furthermore, practitioners should be aware that their inputs (such as the introduction of new techniques, changes in training strategies) do not necessarily create intended effects. From the perspective of systems theory, environmental inputs gain their meaning in a self-referential manner based on the internal logic of the person considered talented. Talent development is therefore highly dependent on communication skills to gain insights into the individual's logic of behavior.

Practitioners also need to reflect on the stories they tell about talent development. There might be individuals within the respective performance domain whose life experiences do not fit the stories practitioners tell about the 'typical' development of 'talent'. Thus, broadening the narrative repertoire might also help make more individuals with their unique life experiences 'fit' to the respective achievement domain and might allow talent development programs to become more effective and successful.

3) Be aware of typical transitions and critical life events along the talent development pathway

Within each talent development pathway, several transitions occur. Practitioners should identify, prepare for, and support individuals through key transitions. Many of these transitions, such as the transition from junior-to-senior levels of competition, might be universal and can be managed on a broad scale. Other circumstances, such as personal critical life events, need to be tackled more individually. Critical life events are an essential feature of successful careers. They can positively influence performance development and the development of other characteristics such as mental strength or resilience – provided that the events are adequately managed (John et al., 2019).

However, the question arises of how practitioners can use these findings; of course, it cannot be said that practitioners should provoke critical life events. Yet, a certain degree of challenge – such as practicing with older or more experienced players from time to time or competing against them and inevitably experiencing failures in the process – might be useful so that individuals considered talented learn to deal constructively with failures. Of course, practitioners need to adequately prepare individuals for these challenges and, above all, offer follow-ups to initiate positive coping processes.

4) Be aware of changes in the nature of the respective performance domain

Performance domains themselves are not static but dynamic. Rules, tactics, and what is required for success in sports change over time, as does the taste of the audience in music or promotion criteria for academics. Thus, it is essential to continually review the decision-making premises on which support measures are based and adapt them accordingly. If talent-related expectations of organizations are not flexible, at some point, it might become more and more difficult to find individuals who fit to these expectations.

Our systems theoretical conceptualization of talent highlights its multidimensional and dynamic nature, with possible adaptive and maladaptive changes along the talent development pathway. Decision-making premises also need to be flexible enough to allow for such variations. For example, in the beginning, physical superiority and comparatively high volumes of structured practice and training might account for success; later, other factors such as self-regulation or mental skills might become more and more important. Therefore, talent development programs should aim to promote the development of skills and habits relevant to performance, especially in the long run.

5) Consider changes in the non-talent-related life worlds of those you aim to support

Another aspect that we need to consider when designing talent development strategies is the changing nature of the life worlds of those that we aim to support in their development. The life world is an essential aspect of a person's individuality. It represents the immediate social space in which a person moves. An athlete's life world, for instance, always also encompasses other aspects (such as family, friends, or school) that do not necessarily have anything to do with sports. These aspects are mostly out of reach for talent-related organizations and cannot be changed easily. However, results from the largest study to date on adolescent elite sports, the GOAL study, suggest that the fit between the non-sporting life world of the athletes and their competitive sports environment represents a significant sporting success factor (Schubring & Thiel, 2011). Therefore, it must be the task of successful talent development strategies to create a fit between different aspects of the individual's life world, however difficult it may be.

Classic expectations regarding the attitudes and behaviors of individuals considered talented (such as determination, high levels of discipline, and willingness to entirely subordinate one's personal life to the demands of the respective performance domain) are

increasingly less in line with non-talent-related aspects of their life worlds. Those responsible for supporting young generations must be aware that the prospect of success is no longer per se a motivating factor for taking on the long, arduous path of a career in sports, music, or mathematics. This is not only because young people today are already under considerable pressure to perform in their everyday school life, but also because they discover new forms of self-expression, self-fulfillment, and competition on the internet, which are associated with far fewer sacrifices and disruptions in their personal lives than a career at the top-level within the aforementioned domains (cf. Thiel & Gropper, 2018; Thiel, Gropper, et al., 2018).

For this reason, in the near future, all performance domains will need to adapt training or practice concepts, didactic teaching methods, leadership styles, and communication structures to the mediatized life worlds of highly individualized adolescents – if they want to ensure the sustainable and long-term promotion of the next generation of athletes, musicians, and mathematicians.

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I hereby declare that the here presented dissertation thesis was written by me. I indicated all sources and aids. I indicated all texts which I quoted directly or paraphrased with regard to content by in-text citations. Full bibliographic information about all citations is provided in the Reference chapter.

I hereby affirm in lieu of oath that this is true and I have not withheld or omitted anything. I am aware that making false declarations in an affidavit is punishable with a prison term of up to three years or a fine.

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Signature

Jannika M. John, Tübingen, 11.10.2021